



CQM Requirements

Version 3a

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1 #A000# Using this Manual

This chapter contains information that helps you understand and use this manual.

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1.1 #A100# Purpose

The document CQM (Card Quality Management) Requirements provides the quality management system requirements and the product requirements relevant for Vendors, Vendor's manufacturing Subcontractors, and personalization bureaus intending to pass through CQM Assessment. In addition, it defines test methods to determine conformity with some of the requirements defined in this document.

It consists of an introductory part, a part defining the quality management system requirements and further parts defining product requirements and related test methods for different products or groups of products.

To gain an initial understanding of CQM's structure and principles, the reader of this document should start with [2.1 #B100# Introduction](#) and then follow the links given there, before studying the remainder of this document.

1.2 #A200# Scope

This manual covers the definition of quality management system requirements and product requirements that are applicable to the design, development, production, and personalization of cardholder devices subject to CQM Assessment.

1.3 #A300# Audience

This manual is intended for the Global Vendors, manufacturers and Personalizers that are involved in the CQM Process. It could also be of interest to Mastercard personnel and customer financial institutions.

1.4 #A400# Referenced Publications

Provisions in this document may refer to other publications maintained by Mastercard or other organizations.

These references are indicated by an acronym in the format: [Acronym].

The acronyms refer to the following documents:

Acronym	Referenced Publication	Version ¹
[cqmAP]	CQM Assessment Plan as available on https://www.smart-consulting.com/card-quality-management	Same as or later than this CQM Requirements
[EMV]	the set of specifications for payment systems as issued by EMVCo from time to time	Latest published versions
[EMV1]	EMVCo – Book 1 – Application Independent ICC to Terminal Interface Requirements	Latest published version
[EMVK]	EMVCo – Level 1 Specifications for Payment Systems – EMV Contact Interface Specification	Latest published version
[EMVD]	EMVCo – Book D – EMV Contactless Communication Protocol Specification	Latest published version
[EMVL]	EMVCo – Level 1 Specifications for Payment Systems – EMV Contactless Interface Specification	Latest published version
[CDS]	Mastercard – Card Design Standards	Latest published version
[CPSP]	M/Chip Card Personalization Standard Profiles	Latest published version
[IS9001]	ISO 9001:2015 - Quality management systems - Requirements	2015
[IS7810]	ISO/IEC 7810 - Identification cards -- Physical characteristics	2019
[IS7811-1]	ISO/IEC 7811-1 - Identification cards -- Recording technique -- Part 1: Embossing	2018

¹ “Version” in this table indicates the version of the referenced specification valid at the time this version of the CQM Requirements was issued. If a newer version of the referenced specification exists at the time the CQM Requirements are applied, the reader of this specification shall research which provisions are applicable for the specific product.

[IS7811-6]	ISO/IEC 7811-6 Identification cards -- Recording technique -- Part 6: Magnetic stripe -- High coercivity	2018
[IS7816-1]	ISO/IEC 7810:2019/Amd 1:2024 Identification cards — Physical characteristics — Amendment 1: Additional requirements for integrated circuit cards with contacts	2024
[IS7816-2]	ISO/IEC 7816-2 - Identification cards -- Integrated circuit cards - Part 2: Cards with contacts -- Dimensions and location of the contacts	2007
[IS7816-3]	ISO/IEC 7816-3 - Identification cards -- Integrated circuit cards -- Part 3: Cards with contacts -- Electrical interface and transmission protocols	2006
[IS10373-1]	ISO/IEC 10373-1 - Identification cards -- Test methods -- Part 1: General characteristics	2020
[IS10373-2]	ISO/IEC 10373-2 - Identification cards -- Test methods -- Part 2: Cards with magnetic stripes	2015
[IS10373-3]	ISO/IEC 10373-3 - Identification cards -- Test methods -- Part 3: Integrated circuit cards with contacts and related interface devices	2018
[IS10373-6]	ISO/IEC 10373-6 - Identification cards -- Test methods -- Part 6: Proximity cards	2025
[IS14443-1]	ISO/IEC 14443-1 - Identification cards -- Contactless integrated circuit cards -- Proximity cards -- Part 1: Physical characteristics	2018
[IS14443-2]	ISO/IEC 14443-2 - Identification cards -- Contactless integrated circuit cards -- Proximity cards -- Part 2: Radio frequency power and signal interface	2020
[IS14443-3]	ISO/IEC 14443-3 - Identification cards -- Contactless integrated circuit cards -- Proximity cards -- Part 3: Initialization and anticollision	2018
[IS14443-4]	ISO/IEC 14443-4 - Identification cards -- Contactless integrated circuit cards -- Proximity cards -- Part 4: Transmission protocol	2018
[MFS]	Mastercard Hologram and Premium Brand Mark specifications	As published from time to time

The Mastercard Card Design Standards are available on www.Mastercardconnect.com.

It is the Vendor's obligation to obtain current versions of the above documents.

Mastercard may replace the above documents with other documents at any point in time. As such this list may not be current or exhaustive.

Where requirements in this document are more stringent than similar requirements defined in other referred documents, for CQM certification conformity with the CQM Requirement is required.

Where the above table of referenced documents contains specific versions or release dates, later versions of the above documents may be applied, but older versions shall not.



Note

Mastercard reserves the right to release or apply new versions of the documents it references in this manual. Vendors shall therefore check the latest documentation versions for the impact of any amendments before starting the Vendor's testing process.

1.5 #A500# Related Information

The following reference materials may be of use to readers:

Reference Materials	
ISO 9000:2015	Quality management systems – Fundamentals and Vocabulary
IATF 16949:2016	Automotive Quality Management System Standard
CQM Process	CQM Process description available at https://www.smart-consulting.com/resources/
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories

1.6 #A600# Definitions

The following definitions are used in this manual:

Definition	Description
Activity	The personalization of cardholder devices, the realization (development and production) of non-personalized cardholder devices, the realization of a Card Component. An activity is a Vendor process eligible for a CQM Label. In some cases, Activities were previously referred to as 'workshops'. A CQM Label applies to an Activity, often related to a specific interface technology (contact, contactless, dual interface)
Batch	A group of products made from the same components and materials, using the same equipment, processes and process parameters, during a defined interval of time.
Batch Number	A unique identifier to distinguish one Batch of products from other Batches of products.

BSM	Biometric Sensor Module, an iacICM containing a biometric sensor, such as a Fingerprint Sensor, a Voice Sensor, or an Image Sensor
Card	A CHD with dimensions as defined in ISO/IEC 7810 "ID-1" format
Card Component	A part of the Cardholder Device for which the CQM scheme foresees a CQM Label. A Component is always related to a well-defined subset of the Mastercard-specified requirements.
Card embossing	Personalization process that creates raised characters on a plastic card body.
Card encoding	Process by which personalization data is written onto a magnetic stripe residing on the card.
Card manufacturing	Card production process composed of one or more of the following: <ul style="list-style-type: none"> • Pre-press (card design layout, printing films, and printing plates generation) • White plastic sheets printing • Sheets assembly • Sheets lamination • Sheets cutting or punching • Hologram and signature panel hot stamping
Card Manufacturing Services	Card production process composed of one or more of the following: <ul style="list-style-type: none"> • Chip embedding • Card Manufacture
Card personalization	Personalization process for unembossed cards that writes data on the card by a technology other than embossing such as laser engraving, thermal transfer, or indent printing
Card Personalization Services	The following services are included <ul style="list-style-type: none"> • Card embossing • Card encoding • Card mailing • Card personalization • Chip personalization
CDS	Mastercard Card Design Standards
CEC Certificate	Certificate issued by Mastercard's sustainable card certification scheme
CEC Scheme	Mastercard's sustainable card certification scheme

Certified Vendor	An organization that has been approved by Mastercard to conduct a certain activity in the card production chain. Vendors are certified for Card Production Services of Mastercard, Maestro, or Cirrus Card products.
Card fulfilment	Stand-alone service by which a newly issued or reissued card is combined with additional materials resulting in a complete package ready for distribution to the cardholder. A facility approved for personalization services is also approved for card fulfilment as part of its personalization activity.
Chip personalization	Process of "writing" data to the integrated circuit by means of electrical or electromagnetic interaction between the chip and personalization device. Chip personalization usually occurs subsequent to chip embedding but may also occur prior to or during chip embedding.
CHD	Card Holder Device, a physical device intended to be provided by an issuer to a cardholder, either as a card or as an alternative device providing equivalent contactless functionality. Within this document, the term CHD shall be understood to exclude mobile phones with payment functionality.
Chip embedding	Process by which an integrated circuit is permanently attached to a payment card to become an integral part of the card
CoC	Certificate of Conformity
CQM	Card Quality Management (Program).
cqmAP	CQM Assessment Plan
CQM Assessment	CQM Audit or remote CQM Remote Assessment
CQM Assessment Plan	Microsoft Excel® file named "cqmAP ..." or "CQM Assessment Plan" containing worksheets corresponding to CQM Products, and additional worksheets used during the CQM Assessment process, also named "cqmAP" in this document
CQM Audit	On-site audit of a Vendor's products and processes for compliance with CQM Requirements
CQM Component	CQM Product that becomes part of another CQM Product during production, e.g. the IC becomes part of the ICM during the ICM production process
CQM Documentation	The Documents and forms that the Vendor receives from Mastercard CQM Operations when passing through the CQM Process. See 1.4 #A400# Referenced Publications for a link to CQM Documentation.
CQM Label	CQM Label granted after successfully passing the CQM Audit, corresponding to a CQM Scope.
CQM Process	The Mastercard Card Quality Management ("CQM") Validation Process. See 1.4 #A400# Referenced Publications for a link to a description of the CQM Process.
CQM Product	A product or service defined in section 2.4.4 #B430# CQM Products , which has a corresponding CQM Label.

CQM Recognition	CQM Label granted for a maximum of 6 months following successful demonstration of some level of conformity with the CQM Requirements plus provision of a plan of how to achieve full compliance satisfactory to the CQM Certification Body, plus proof of having arranged a CQM on-site audit within 6 months. Grant of a CQM Recognition Label is done upon sole discretion of the CQM Certification Body.
CQM Remote Assessment	CQM Assessment conducted via Electronic Conferencing tools and electronic information exchange, instead of an on-site CQM Audit
CQM Requirements	This document
CQM requirements	The requirements defined in this document
CQM Scope	A set of CQM requirements applicable to a specific CQM Product, equivalent to the scope of the CQM Audit. When the Vendor is found sufficiently compliant as the result of a CQM Audit, the Vendor receives a CQM Label corresponding to the CQM Scope audited.
CQM Subscope	A set of CQM requirements applicable to a specific CQM Variant, specifying which subset of the CQM requirements are applicable to a specific CQM Variant of a CQM Product, for example a Fingerprint Card ("fpIAC") is a CQM Subscope of an Interactive Card ("IAC").
CQM Sublabel	Additional information added to a CQM Label specifying which CQM Variants of a CQM Product or a CQM Components are covered by the CQM Label, corresponding to a CQM Subscope
CQM Variant	product or process variant of a CQM Product, represented by a defined set of CQM requirements as defined in the cqmAP
CSI	Mastercard scheme to assess and manage the risk resulting from innovative changes to the card construction, e.g. where the card contains elements not covered by CQM, or where a change to the card construction makes the resulting product not CQM conform, but such deviation is wished by an issuer.
Data preparation	Stand-alone service by which issuer and cardholder data are processed and configured for subsequent personalization by the issuer or different certified vendor. A facility approved for personalization services is also approved for data preparation as part of its personalization activity.
GVCP	Mastercard's Global Vendor Certification Program. GVCP is complimentary to the CQM program and mandatory for all card vendors performing the applicable activities in the card production chain. It manages site security compliance, by ensuring that vendors meet the PCI Security Standards Council (PCI SSC) standards for secure payment card production. (both the PCI Card Production Physical Security Requirements and PCI Card Production Logical Security Requirements)
IAC	InterActive Card, a card that supports direct interaction with the card holder (not via a terminal or computer), such as cards containing a display, an LED, push buttons, fingerprint sensors etc.
iacIL	InterActive Card InLay, an inlay containing the electronics of, and intended to produce an IAC from. The typical difference between an IAC and an iacIL being that the iacIL lacks the printed layers on the top and bottom.

IC	Integrated Circuit; unless stated explicitly otherwise, an IC is an integrated circuit containing a version of the MChip application.
ICC	Integrated Circuit Card – a plastic card containing an IC
ICM	Integrated Circuit Card Module – one IC, typically the secure element, packaged into a module, with contacts or connectors for an antenna or both
iacICM	Integrated Circuit Card Module containing additional functionality – an ICM containing more components than just one secure element, e.g. multiple IC, or an IC and additional discrete capacitors or resistors. An iacICM may have external contacts or connectors for an antenna or both or neither.
ID-1	The prefix "ID-1" is used to indicate a cardholder product with the standard card dimensions as defined in the ISO 7810 standard for the "ID-1" format
IL	An InLay, either an AIL, KIL, PIL
Job	A group of products made using the same equipment, processes and process parameters, during a defined interval of time, consisting of one or multiple batches; typically used in Personalization to group multiple batches of cards that will be personalized using the same equipment, components and settings
Job Number	A unique identifier to distinguish one Job of products from other Jobs of products.
Lot	A Batch or a Job
Lot Number	A unique identifier to distinguish one Lot of products from other Lots of products
MSA	Mechanically Sensitive Area – term used in #8270#, see there for a detailed definition.
P	Personalization of a cardholder device
Partial manufacture	Facility that produces card components containing sensitive security features or personalization data where the full card is subsequently completed by a certified vendor.
Personalizer	The entity contracting with the issuer for the provision of personalization services.
PIN printing	Stand-alone service whereby a PIN mailer is printed and mailed. A facility approved for personalization
Process	Set of activities converting inputs into an output
Process Change	Change to a characteristic of a process that may change its performance or output
Process Qualification	Verification that an implemented process complies with the underlying Process Specification and produces the desired output
Process Specification	Documented characteristics of a process, including actions, parameters, materials, process targets

Process Variant	<p>Variant of a CQM Product, distinguished from other variants of that same CQM Product by differing process flows, e.g. a Dual-interface IC Card produced using an IC Module containing the IC, or one using an Inlay containing the IC</p> <p>Process Variants of CQM Products are detailed in section 3.2.2 #C220# CQM Process Variants</p>
Product	Result of combining and processing materials and components, having certain characteristics, result of an Activity
Product Change	Change to a product's materials, components, or the processes used to create the product, that may result in changing the Product's conformity to its Product Specification.
Product Family	Group of different Products sharing a significant part of their characteristics and components
Product Qualification	Verification that an actual product complies with a Product Specification
Product Specification	Documented characteristics of a Product
Product Variant	<p>Variant of a CQM Product, distinguished from other variants of that CQM Product by technical differences such as a different combination of interfaces,, e.g. if an IC has a contact or a contactless interface</p> <p>Product Variants of CQM Products are detailed in section 3.2.3 #C230# CQM Product Variants</p>
Qualification	<p>Design & Development Validation. The word Qualification is used in CQM Documentation to indicate that:</p> <p>Validation is versus Mastercard-specified requirements</p> <p>Validation is done via tests on representative test vehicles</p>
Rms	Root mean square
Sample size	Number of samples to be tested, the unit being the CQM Product, e.g. the IC (and not the wafer), the ICM (and not the roll or a single wire bond), the CB (and not the lamination sheet) etc.
Set-up	Change of process or process parameters, or restarting after a stand-still or a maintenance operation, may encompass multiple batches of identical products
SFD	Switching Field by Derivative, see ISO/IEC 7811-6 for details
Site	A physical location.
Specialized Card Production Services	<p>The following services are included</p> <ul style="list-style-type: none"> • Card fulfilment • Data preparation • Disaster recovery • Mobile provisioning • Partial manufacture • PIN printing

Subcontractor	Entity providing design, qualification, or manufacturing services to a Vendor, related to a CQM Product or Component marketed by the Vendor
Supplier	Vendor providing Cards or Card Components, or add-ons such as hologram, PBM, or signature panel to a Vendor
Vendor	A Card Vendor or, Card Personalizer, or a Supplier of a CQM Component to the Card Vendor.

1.7 #A610# CQM Products, CQM Components, and CQM Variants

1.7.1 Introduction — CQM Scopes and Subscopes

CQM requirements apply to a range of CQM Products and Components (subsequently referred to as "products"), such as IC Cards ("ICC") or IC Modules ("ICM").

Each set of CQM requirements applicable to a specific CQM product or component is considered a CQM Scope.

The CQM requirements encompassed by a CQM Scope constitute the requirements applicable to the corresponding CQM Product.

Within a CQM Scope, a range of CQM Subscopes are defined.

The CQM requirements encompassed by a CQM Subscope constitute the requirements applicable to the corresponding CQM Variant of a certain CQM Product.

CQM Subscopes can be of a technical nature, for example the following CQM subscopes of the CQM Scope for the CQM Product Inlay:

- Inlays only containing a wire embedded antenna
- Inlays containing an antenna and an IC

CQM Subscopes can relate to different phases in the lifecycle of a product, for example:

- Development
- Qualification
- Production

CQM Subscopes can relate to different roles in the supply chain, for example:

- Vendor of an IC, responsible for development, qualification, and production of the IC
- Subcontractor to IC Vendor, providing only testing services

1.7.2 CQM Products and CQM Variants

The following CQM Products and CQM Variants are used in this manual:

CQM Variants of CQM Product: IC		
Acronym	Name	Definition
IC	Integrated Circuit	Integrated electronic Circuit; typically the secure element containing a version of the MChip application; but the term includes other integrated circuits integrated into the card
kIC	contact IC	IC with a Contact Interface
pIC	proximity IC	IC with a Contactless Interface (Proximity IC)
tstIC	test IC Wafer	Testing IC Wafers
bckIC	backside treatment of IC Wafer	Grinding and polishing IC Wafer
rdlIC	Apply redistribution layer onto IC Wafer	Applying a Redistribution Layer to the IC Wafer
bmpIC	bumping the IC Wafer	Applying Bumps to the IC Wafer
sawIC	sawing the IC Wafer	Sawing the IC Wafer
venIC	Vendor for IC	Providing own IC as a Component Vendor
subIC	Subcontractor to IC Vendor	Providing IC Manufacturing Services as a Subcontractor
devIC	develop IC	Designing an IC
qualIC	qualify IC	Qualifying an IC
prdIC	produce IC	Producing or processing IC Wafers
CQM Variants of CQM Product: ICM		
Acronym	Name	Definition
ICM	IC Module	Integrated Circuit Card Module – one IC, typically the secure element, packaged into a module, with contacts or connectors for an antenna or both
kICM	contact ICM	ICM with a Contact Interface
pICM	proximity ICM	ICM with a Contactless Interface
aICM	antenna ICM	ICM including ISO/IEC 14443 Antenna
venICM	Vendor for ICM	Providing own ICM as a Component Vendor
subICM	Subcontractor to ICM Vendor	Providing ICM Manufacturing Services as a Subcontractor
devICM	develop ICM	Designing an ICM
qualICM	qualify ICM	Qualifying an ICM
prdICM	produce ICM	Producing an ICM
CQM Variants of CQM Product: IL		
Acronym	Name	Definition
IL	Inlay	An Inlay in the card construction, usually containing at least an antenna to make a contactless card
aIL	antenna Inlay	Inlay with an antenna, but no IC; An Inlay containing an antenna, but no IC. Typically used to produce ICC.
kIL	contact Inlay	Inlay with 7816-2 contacts

pIL	proximity Inlay	An inlay to produce pICC, containing an antenna and an IC
icIL	IC Inlay	Inlay produced using an unpackaged IC, eg using wire or flip-chip bonding
mIL	Module Inlay	Inlay produced using a packaged IC, eg an ICM
venIL	Vendor for IL	Providing own IL as a Component Vendor
subIL	Subcontractor to IL Vendor	Providing IL Manufacturing Services as a Subcontractor
devIL	develop IL	Designing or developing an IL
qualIL	qualify IL	Qualifying an IL
prdIL	produce IL	Producing an IL
CQM Variants of CQM Product: CB		
Acronym	Name	Definition
CB	Cardbody	A card without an embedded IC
iCB	inlay Cardbody	CB containing an inlay (but no IC)
pCB	plastic Cardbody	Cardbody made primarily from Plastic
meCB	metal Cardbody	Cardbody made primarily from Metal
woCB	wooden Cardbody	Cardbody made primarily from Wood
paCB	paper Cardbody	Cardbody made primarily from Paper
venCB	Vendor for CB	Providing own CB as a Component Vendor
subCB	Subcontractor to CB Vendor	Providing CB Manufacturing Services as a Subcontractor
devCB	develop CB	Designing or developing a CB
quaCB	qualify CB	Qualifying a CB
prdCB	produce CB	Producing a CB
CQM Variants of CQM Product: ICC		
Acronym	Name	Definition
ICC	IC Card - Card containing an IC	Integrated Circuit Card – a card containing an IC
kICC	contact ICC	IC Card having a Contact Interface
pICC	proximity ICC	IC Card having a Contactless Interface
mICC	module based ICC	ICC produced using an ICM containing the IC
iICC	inlay based ICC	ICC produced using an IL containing the IC; an ICC produced without an ICM, but by laminating an Inlay already containing the IC, the contact plate, and the antenna between plastic layers
pICC	plastic ICC	IC Card made primarily from Plastic
meICC	metal ICC	IC Card made primarily from Metal
woICC	wooden ICC	IC Card made primarily from Wood
paICC	paper ICC	IC Card made primarily from Paper
ledICC	led ICC	ICC with LED indicating card is exposed to reader field, and the LED not being controlled, directly or indirectly, by the payment application inside the card. If the LED is controlled by the payment controller, then the card is a ledIAC.
venICC	Vendor for ICC	Providing own ICC as a Component Vendor
subICC	Subcontractor to ICC Vendor	Providing ICC Manufacturing Services as a Subcontractor

devICC	develop ICC	Designing or developing an ICC
qualICC	qualify ICC	Qualifying an ICC
prdICC	produce ICC	Producing an ICC
CQM Variants of CQM Product: P		
Acronym	Name	Definition
P	Personalized card	Personalization of a cardholder device
kP	contact Personalization	Personalize via the Contact Interface
pP	proximity Personalization	Personalize via the Contactless Interface
mP	magnetic stripe Personalization	Personalizing the Magnetic Stripe
eP	embossing Personalization	Graphical Personalisation using Embossing
tP	thermal transfer Personalization	Graphical Personalisation using Thermal Transfer
iP	indent Personalization	Graphical Personalisation using Indent Printing
lP	laser Personalization	Graphical Personalisation using Laser Printing
dP	drop-on-demand Personalization	Graphical Personalisation using Drop-on-Demand or Inkjet Printing
ic2P	indent CVC2 Personalization	Graphical Personalisation of the CVC2 using Indent Printing
venP	Vendor for Personalization	Providing Personalization Services as a Vendor
subP	Subcontractor to Personalization Vendor	Providing Personalization Services as a Subcontractor
devP	develop Personalization Profiles	Designing or developing a Perso Profile
quaP	qualify Personalization Profiles	Qualifying a Perso Profile
prdP	produce Personalization	Personalizing Cardholder Devices
CQM Variants of CQM Product: IACICM		
Acronym	Name	Definition
IACICM	Module for producing IAC	InterActive Card Integrated Circuit Module, an ICM containing additional functionality compared to a common dual interface card ICM – an ICM containing more components than just one secure element, e.g. multiple IC, or an IC and additional discrete capacitors or resistors. An iacICM may have external contacts or connectors for an antenna or both or neither.
klACICM	contact IACICM	IACICM with a Contact Interface
plACICM	proximity IACICM	IACICM with a Contactless Interface

aIACIM	antenna IACIM	IACIM including ISO/IEC 14443 Antenna
dIACIM	display IACIM	IACIM including a display
venIACIM	Vendor for IACIM	Providing own IACIM as a Component Vendor
subIACIM	Subcontractor to IACIM Vendor	Providing IACIM Manufacturing Services as a Subcontractor
devIACIM	develop IACIM	Designing an IACIM
qualIACIM	qualify IACIM	Qualifying an IACIM
prdIACIM	produce IACIM	Producing an IACIM
CQM Variants of CQM Product: BSM		
Acronym	Name	Definition
BSM	Biometric Sensor Module	Biometric Sensor Module, an iacIM containing a biometric sensor, such as a Fingerprint Sensor, a Voice Sensor, or an Image Sensor
fpBSM	fingerprint BSM	Biometric Sensor Module with a Fingerprint Sensor
vcBSM	voice BSM	Biometric Sensor Module with a Voice Sensor
imBSM	Biometric Sensor Module with an Image Sensor	Biometric Sensor Module with an Image Sensor
venBSM	Vendor for BSM	Providing own BSM as a Component Vendor
subBSM	Subcontractor to BSM Vendor	Providing BSM Manufacturing Services as a Subcontractor
devBSM	develop BSM	Designing a BSM
quaBSM	qualify BSM	Qualifying a BSM
prdBSM	produce BSM	Producing a BSM
CQM Variants of CQM Product: IACIL		
Acronym	Name	Definition
IACIL	Inlay for producing IAC	InterActive Card InLay, an inlay containing the electronics of, and intended to produce an IAC from. The typical difference between an IAC and an iacIL being that the iacIL lacks the printed layers on the top and bottom.
aIACIL	antenna IACIL	IAC Inlay with an antenna, but no IC
kIACIL	contact IACIL	IAC Inlay with 7816-2 contacts
pIACIL	proximity IACIL	IAC Inlay with an antenna and an IC, but no 7816-2 contacts
icIACIL	ic IACIL	iacIL with at least one unpackaged IC
ledIACIL	led IACIL	iacIL with RFID indicating LED
mIACIL	module IACIL	iacIL with at least one IC packaged into an ICM
ciIACIL	chip IACIL	iacIL with at least one IC (packaged or unpackaged)
venIACIL	Vendor for IACIL	Providing own IACIL as a Component Vendor
subIACIL	Subcontractor to IACIL Vendor	Providing IACIL Manufacturing Services as a Subcontractor
devIACIL	develop IACIL	Designing or developing an IACIL
qualIACIL	qualify IACIL	Qualifying an IACIL
prdIACIL	produce IACIL	Producing an IACIL
CQM Variants of CQM Product: IAC		
Acronym	Name	Definition

IAC	Interactive Card	InterActive Card, a card that supports direct interaction with the card holder (not via a terminal or computer), such as cards containing a display, an LED, push buttons, fingerprint sensors etc.
klAC	contact IAC	IAC having a Contact Interface
plAC	proximity IAC	IAC having a Contactless Interface
mlAC	module IAC	IAC produced using an ICM containing the IC
ilAC	inlay IAC	IAC produced using an IL containing the IC; an IAC produced from an iacil containing the ICs, thus the manufacturing process not incorporating IC packaging process steps.
iclAC	ic IAC	IAC produced using bare dice; an IAC produced without an iacIL, thus the manufacturing process incorporates IC packaging process steps
dlAC	display IAC	IAC with a Display
fplAC	fingerprint IAC	IAC with Fingerprint Sensor
vclAC	voice IAC	IAC with Voice Sensor
ledIAC	led IAC	IAC with LED indicating card is exposed to reader field; if the only interactive component in the card is the LED, and the LED has no functional connection with the payment controller and only indicates if the card is exposed to the reader field, then the card is an ledICC.
btIAC	bluetooth IAC	IAC with a Bluetooth Interface
venIAC	Vendor for IAC	Providing own IAC as a Component Vendor
subIAC	Subcontractor to IAC Vendor	Providing IAC Manufacturing Services as a Subcontractor
devIAC	develop IAC	Designing or developing an IAC
qualIAC	qualify IAC	Qualifying an IAC
prdIAC	produce IAC	Producing an IAC

1.8 #A700# Requirement, Recommendation, Permission – Shall, Should, May

This document follows the ISO/IEC Directives Part 2 with respect to the use of auxiliary verbs to identify the type of a provision in this document, as outlined in the following table:

Type of Provision	Auxiliary Verb	Description
Requirement	Shall Shall not	expression conveying criteria to be fulfilled and from which no deviation is permitted if compliance is to be claimed
Recommendation	Should Should not	expression conveying a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others

Type of Provision	Auxiliary Verb	Description
Permission	May Need not	expression conveying consent or liberty (or opportunity) to do something
Possibility	Can Cannot	expression conveying expected or conceivable material, physical or causal outcome
Capability	Can Cannot	expression conveying the ability, fitness, or quality necessary to do or achieve a specified thing
External constraint	Must	constraint or obligation on the user of the document, typically due to one or more legal requirements, laws of nature, or rules defined outside of this document, that is not stated as a provision of the standard

1.9 #A800# Revisions

Mastercard reserves the right to:

- Change the CQM Requirements and its associated products, services and requirements including CQM Labels.
- Stop the CQM Requirements including the withdrawal of all CQM Labels.

When there is a change to the CQM Requirements and the related requirements, Mastercard will:

1. Issue a new version of the CQM Requirements documentation.
2. Inform the registered CQM Vendors' Primary Contacts of the availability of a new revision, typically via e-mail
3. Fix the activation date for the new CQM Requirements.
4. Fix the deactivation date for the old CQM Requirements.

Depending on the scope of changes, Mastercard will decide when to accept the CQM Label requests based on either the new or the old CQM Requirements.



Note

It is the Vendor's obligation to verify at relevant points in time the current version of the CQM Requirements and CQM Assessment Plans. Relevant points in time include sufficiently prior to relevant assessments, such as Vendor's self-assessment, product and component qualification, and CQM Audits, as well as reasonably 'from time to time'.

The CQM Requirements and the CQM Assessment Plans in their current version are published via the following website:

<https://www.smart-consulting.com/card-quality-management/>

It is also the Vendor's obligation to ensure CQM Operations and the relevant CQM Auditor(s) are always informed about who is the Vendor's Primary Contact towards the CQM entities and what is the Primary Contact's e-mail and phone number.

1.10 #A900# Revision Overview

Version	Date Published	Author
1.5	2001	Uwe Trüggelmann
1.9D	February 2004	Bruno Beyls
2.02	February 2013	Uwe Trüggelmann
2.03	May 2013	Uwe Trüggelmann
2.15	June 2015	Uwe Trüggelmann
2.16	July 2016	Uwe Trüggelmann
2.17	February 2018	Uwe Trüggelmann
2.18	December 2018	Uwe Trüggelmann
2.19	January 2020	Uwe Trüggelmann
2.19.1	May 2020	Uwe Trüggelmann
2.22	November 2022	Uwe Trüggelmann
3a	June 2025	Uwe Trüggelmann

1.11 #AA00# Main Changes in Revision 2.19

This revision of the CQM Requirements introduces the following main changes:

- Various clarifications in the QMS sections
- **#3100#: Cards made of materials other than newly produced PVC, and cards with an associated environmental claim – Requirement to maintain a valid CSI Letter**

amended with provisions regarding environmental claims. **#3200#: CB, ICC, and IAC – Requirement to maintain a valid Mastercard Card Vendor Conformity Statement ("CVCS")** introduced

- For logo color measurement standard method is now CIEDE2000
- Major revision of **#3036#**: Hologram (including PBM), and the related test method, to align with Mastercard hologram supplier specification
- Revised provisions related to non-standard cards and CSI, e.g. **#3100#** Cards made of materials other than newly produced PVC – Requirement to maintain a valid CSI Letter, and equivalent for IAC added as **#3110#**
- Fully described the antenna current alternative in **#3064#: Reading Distance**, and other improvements to the text
- Simplifications for monitoring during Personalization
- Product structure revised, and IAC now both separate products, and each have own worksheet in cqmAP.
- Revised requirements for Inlay for Interactive Cards ("") and Interactive Cards ("IAC").

For detail lists of the changes from the two previous versions see the tables in section **16**.

For a detail list of the changes for each requirement and test method see the header table at the beginning of each requirement or test method section.

1.12 #AA01# Main Changes in Revision 2.19.1

This revision of the CQM Requirements introduces the following main changes:

- Major rewrite of section **2.4 #B400# CQM Products and CQM Labels, and Modular Certification**
- Major rewrite of section **3.2 #C200# Determining the applicable CQM Products**
- Changes to the naming and structure of products, including their variants
- Minor corrections.

1.13 #AA02# Main Changes in Revision 2.22

Adjustments to latest revisions of ISO/IEC 7810 and 10373-1.

Full alignment of magnetic stripe requirements to ISO/IEC 7811-6.

Expanding IAC requirements to accommodate fingerprint cards better.

Clarifications and details to better handle subcontracting versus procuring from CQM certified suppliers, which has become more relevant with the more complex IAC supply chains.

1.14 #AA03# Main Changes in Revision 3a

Version 3a introduces the following main changes:

1.14.1 Introduction

Version 3a introduces the following main changes:

- Substantially increased granularity of products and processes for audit and certification scope.
- Introduction of the severity of Critical Non-Conformity ("NCC") into the CQM system. A NCC prevents certification until resolved.

1.14.2 Quality Management System Requirements

- *#0654#: Design and Development – Product Qualification Report* — Lack of qualification data, and major NC without CSI letter now prohibit CQM certification
- IQC (Incoming Quality Control) to be assessed during CQM Audits for each CQM product and component, and not just once as part of the QMS
- *#0662#: Requirements for Products and Services – Determining the Requirements for Products and Services, Order Specification* — Order Specification appended to title to clarify that an Order Specification is required, verbiage added to clarify Order Specification
- *#0703# Release of Product and Services, Batch Yield Limit* — split into two independent requirements: *#0703#: Production and Service Provision – Release of Product and Services* and *#0707#: Production and Service Provision – Batch Yield Limit*; Batch Yield Limit now only applicable to products containing an IC.
- Requirements to implement SPC (*#0705#: Performance evaluation – Statistical Process Control*) and CpK (*#0811#: Performance evaluation – Process Capability*) restricted to ic, icm, iacim, bsm, il, iacil, iac, that is, where processes involve wafer processing or IC packaging processes.
- A range of QMS requirements, primarily around the design process, moved from QMS worksheet in cqmAP to product specific worksheets, requiring the related processes to be in place for each CQM product, and to be verified during the CQM Audit for each CQM product.

1.14.3 Product Requirements

- *#3046#: Resistance to Chemicals* — For CQM products and components where *#3058#: Solidity – Adhesion of ICM to Card* is required, clarified that one sample per solution shall be tested for *#3058#: Solidity – Adhesion of ICM to Card*
- *#3050#: ESD Conductivity – ESC* — Increased permitted levels of ESD conductivity
- *#3067#: Suitability for an Identification Notch* — Permitting greater tolerances
- *#3110#: IAC – Interactive Cards – Requirement to maintain a valid CSI Letter* — restricted to specific products, clarified to which products and components this requirement still applies.
- *#3120#: Pilot, innovative, and interactive cardholder identification products – requirement to undergo CQM Audits depending on annual production volume* — New requirement easing CQM audit and CQM certification requirements for innovative and interactive cardholder products with very small volumes.

- #3130#: *Products that are not compliant with applicable CQM requirements – Requirement to maintain a valid CSI Letter* — Now an individual requirement to clarify better that CQM non conformities must be covered by a CSI letter.
- #3057#: *3 wheel Test Robustness for Interactive Cards ("IAC") and ICC made without an ICM* — added clarification regarding re-using samples and regarding interpretation of test results with higher force than required.
- #2041#: *Fingerprint Sensor – Resistance to Abrasion* — Reworded to improve understanding.
- #3058#: *Solidity – Adhesion of ICM to Card* — Separate minimum value defined for rupture of the ICM, provided the ICM remains attached in all corners of the ICC.
- #2805#: *Antenna Design – Minimum distance between mechanical personalization areas and the antenna in IL, ICC, IAC* — Wording revised to better accommodate IAC.

1.14.4 Test methods

- #7010#: *Pantone-Colours* — specified measurement parameters for colour measurement using spectrometer
- #7120#: *Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) – Adhesion, Aspect and Shape, Size and Positioning* — clarified that if cross-hatch necessary, a new sample shall be used
- #8093#: *Temperature Cycling* — extended maximum period between removal from oven and verification of functionality to 72 h to accommodate weekends
- #8230#: *Solidity – ICM Adhesion – Back of Card Spot Pressure Test* — Clarified positioning of centre of pressure for multicentric ICM, for example combining ISO/IEC 7816-2 contacts and a fingerprint sensor into a single ICM
- #8310#: *Resistance of a Fingerprint Sensor against Scratching* — Additional details specified

1.14.5 November 2025 edition

Version 3a of the CQM Requirements and the corresponding cqmAP was edited to correct some inconsistencies between the text of some requirements, the corresponding header tables at the beginning of these requirements, and the corresponding rows in the cqmAP, and reissued in November 2025. As these changes are minor editorial changes, no new revision number was assigned.

Anyhow, earlier editions of V3a of the CQM Requirements and the cqmAP shall no longer be used.

1.15 #AB00# Support

Please address your CQM queries to:

<u>Support Area</u>	<u>E-mail</u>
CQM Operations	cqm@smart-consulting.com

Support Area	E-mail
Mastercard CQM Support	cqm_support@Mastercard.com
CQM Requirements Maintenance	cqm_support@Mastercard.com with cc to
CQM technical queries	cqm@smart-consulting.com

Other relevant Mastercard contacts for Card Vendors:

Support Area	E-mail
Card Body Innovation – CSI	CSI_Security@Mastercard.com
Card Design	card_design@mastercard.com
Mastercard Branding Requirements	ask_brand_manager@Mastercard.com
Cardholder Device Testing and Approvals	Chip_Certification_chd@Mastercard.com
Cardholder Device Support	Chip_Certification_Support@Mastercard.com
Hologram or Holomag® ordering	Holograms@Mastercard.com
Logical and Physical Security Certification of vendors	GVCP_Helpdesk@Mastercard.com

1.16 #AC00# Additional Requirements

This document does not specify all requirements for card products and their components and their manufacturing.

Mastercard specifies requirements for functional (e.g. related to the functionality of the chip or the magnetic stripe) and visual characteristics additional to the requirements specified in this document. Please consult the applicable Mastercard documentation to understand these functional requirements and the related conformity assessment processes.

Part A

Introduction, Principles, and Applicability of Requirements

2 #B000# Introduction and Principles

This chapter provides an introduction to the CQM Requirements, defines some principles and provides some guidance about how to implement the CQM Requirements.

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2.1 #B100# Introduction

The Mastercard CQM Program is implemented through an assessment process, the Mastercard CQM Assessment Process.

The CQM Assessment Process determines conformity of a Vendor's products and processes with a set of requirements.

Subject to certain conditions, vendors receive a "CQM Label" as a confirmation that the vendor has successfully passed CQM Assessment for a specific CQM Product.

This document defines the requirements a Vendor must comply with to successfully undergo CQM Assessment.

To gain understanding into the modular product and certification structure of CQM, the reader of this document is advised to initially study the following two sections and their sub-sections, before reading through the remainder of this document:

- **2.4 #B400# CQM Products and CQM Labels, and Modular Certification**
- **3.2 #C200# Determining the applicable CQM Products**

2.2 #B200# Mastercard Card Approval Programs and Dependencies

Mastercard's Approval programs and processes are described in the Card Approval Guide for Vendor published on the Mastercardconnect website in the Chip and Chip Related Publications page.

2.2.1 #B210# Non-standard card materials, environmental claims, and CSI

CQM applies independent of the materials a card is made of, but a significant percentage of non-standard material in a card, card constructions containing specific components, and any card construction not fully compliant with all applicable CQM requirements requires the involvement of Mastercard's CSI program.

See **#3100#: Cards made of materials other than newly produced PVC, and cards with an associated environmental claim – Requirement to maintain a valid CSI Letter** for what constitutes 'non-standard materials' and 'significant percentage' in the sense of this clause.

A Vendor intending to market and supply cards (CB, ICC, etc) made with significant amounts of non-standard materials shall:

- fully test the cards in accordance with the applicable CQM requirements,
- complete a CQM Assessment Plan ("cqmAP") dedicated to this specific card product to document the card's performance in the relevant CQM tests and the Vendor's quality control measures for producing this card,

- submit the cqmAP to Mastercard CSI together with the required forms and request a CSI Letter for a card made from non-standard materials.



Note

Non-ISO or non-PVC Cards, non-ID1 form factors, innovative card bodies (like holofoil, metal) and interactive or innovative products embedding new technology that do not fully comply with applicable CQM requirements are subject to the CSI review process. Card Vendors should contact CSI_Security@mastercard.com to demonstrate that their products are durable, secured and interoperable.

The vendor shall comply with **#3100#: Cards made of materials other than newly produced PVC, and cards with an associated environmental claim – Requirement to maintain a valid CSI Letter** for cards:

- containing a significant percentage of non-standard materials, and/or
- not complying with all applicable CQM requirements, and/or
- Cards containing a holofoil or other continuous metallic layer

2.2.2 #B220# InterActive Cards ("IACs"), including cards with integrated biometric sensors, and CSI

CQM applies also to advanced card products, referred to as InterActive Cards ("IACs"), but such card products usually require the involvement of Mastercard's CSI program. IACs include any card product in the ISO/IEC 7810 ID-1 format or the ISO/IEC 18328-2 ID-T format containing a biometric sensor.

A Vendor intending to market and supply IACs shall:

- fully test the cards in accordance with the applicable CQM requirements,
- complete a CQM Assessment Plan ("cqmAP") dedicated to this specific card product to document the card's performance in the relevant CQM tests and the Vendor's quality control measures for producing this card,
- submit the cqmAP to Mastercard CSI together with the required forms and request a CSI Letter for an IAC.



Note

Non-ISO or non-PVC Cards, non-ID1 form factors, innovative card bodies (like holofoil, metal) and interactive or innovative products embedding new technology that do not fully comply with applicable CQM requirements are subject to the CSI review process. Card Vendors should contact CSI_Security@mastercard.com to demonstrate that their products are durable, secure and interoperable.

The vendor shall comply with **#3110#: IAC – Interactive Cards – Requirement to maintain a valid CSI Letter** for InterActive Cards (including cards containing biometric sensors).

2.3 #B300# Versions & Revisions

2.3.1 Before V3

This document and the corresponding assessment plan are revised on a regular basis.

The result of a revision with added, removed or technically modified requirements is a new "Version"

To distinguish different Versions, a version counter is used in the format "MM.mm", where:

- MM is the Major Version counter, single or two digits
- mm is the Minor Version counter, single or two digits

Occasionally, to indicate a revision of a version following shortly after a version was published, another digit might be appended, separated from the Minor Version counter by a dot, e.g. 2.19.1.

With the change from version V2.2 to V2.03, the Minor Version counter was changed from one digit to two digits.

A Major Version is issued when there are substantial changes to the CQM Requirements, e.g. a new product is added, an existing product is removed, or a substantial number of requirements have been added, removed or modified.

A minor version is issued when there are small changes to the CQM Requirements, e.g. a few requirements have been added, removed or modified, such as would occur to adjust to a revision of one of the ISO/IEC standards.

2.3.2 Beginning with V3

Beginning with V3a, the Identification of CQM Requirements versions was modified to a format consisting of a number followed by a Latin letter, for example: 4c.

- The number is the Major Version counter, single or two digits
- The letter is the Minor Version counter, always a single lowercase letter, starting with "a"

A Major Version is issued when there are substantial changes to the CQM Requirements, e.g. a new product is added, an existing product is removed, or a substantial number of requirements have been added, removed or modified.

A Minor Version is issued when there are small changes to the CQM Requirements, e.g. a few requirements have been added, removed or modified, such as would occur to adjust to a revision of one of the ISO/IEC standards.

During preparation of a new version, or to correct a minor error (both subsequently collectively referred to as an "Edit"), an optional Edit Counter in the form of an integer number might be added behind the Minor Version counter, eg 4c5 to indicate the 5th edit of version 4c. An Edit Counter indicates that the presented document has been edited based on the version indicated by the Major and Minor Version counters.

The cqmAP version to be used when determining compliance with a specific version of the CQM Requirements shall at least be the same version as the requirements, or a later version or edit.

2.4 #B400# CQM Products and CQM Labels, and Modular Certification

2.4.1 #B405# Introduction

CQM assesses a vendor's ability to design, qualify, and produce a specific "*CQM Product*" in a specific production site.

The extent of the vendor's ability is determined through a formalized way of assessing the vendor's conformity to a set of "*CQM requirements*" relevant to each CQM Product. The way of assessing the vendor's conformity is in this document referred to as "*CQM Assessment*".

If a vendor successfully demonstrates a specific site's conformity to design, qualify, and produce a specific CQM Product in conformity with the applicable CQM requirements, the vendor receives for that specific combination of site and CQM Product a "*CQM Label*". All valid CQM Labels a Vendor has received are listed together in a document called "*CQM Certificate*".

CQM requirements are defined in this document, beginning with section **4 Quality Management System Requirements**, subsequently referred to as "*CQM Requirements*" or "*CQMR*". A corresponding document called "*CQM Assessment Plan*", in this document often referred to as "*cqmAP*", defines which CQM requirements are applicable to specific CQM Products and their variants.

CQM Products and their CQM Variants are defined in 1.7#A610# CQM Products, CQM Components, and CQM Variants.

These CQM Variants are not fully considered at the level of CQM Labels, but at the level of CQM Assessment and are defined in defined in 1.7#A610# CQM Products, CQM Components, and CQM Variants.

If a vendor has received a CQM Certificate including a specific site, then the site is considered in this document as "*CQM certified*" for the CQM Product corresponding to that CQM Label.

If a product is produced by a site that has received a CQM Label for the corresponding CQM Product and CQM Variant, then the product is considered in this document as "*CQM compliant*".

2.4.2 #B410# Modular Certification – Introduction

CQM is a modular certification system. For example, a specific IC production site can be CQM certified once and receive its CQM Label independently from a specific card vendor's supply chain. Then ICs produced in that production site, and embedded in cards by any

CQM certified card vendor may be assumed CQM compliant, independent of the card vendor's supply chain, and independent of the specific card vendor's card construction.

CQM allows flexibility in the certification approach. A specific IC production site for example can be CQM certified as part of a specific card vendor's supply chain, or independent of a specific card vendor's supply chain.

If the IC production is CQM assessed independently from a specific card vendor's supply chain, and it is the IC Vendor applying for CQM Assessment and CQM Certification, then the IC Vendor will receive the CQM Label for IC production. ICs from that production may then be assumed CQM compliant for every card vendor obtaining the IC directly or indirectly (that is via another vendor) from this IC vendor.

If, on the other hand, the IC is CQM assessed as part of a specific card vendor's supply chain, and it is the card vendor applying for CQM Assessment and CQM Certification of the IC production, then the card vendor will receive the CQM Label for IC production in this site. ICs from that production may then be assumed CQM compliant only for the ICs the card vendor has produced in that IC production site. ICs from that production may then be assumed CQM compliant when it is contained in the card vendor's card constructions, and in card constructions made by other card vendors who have obtained the IC from the card vendor. But the CQM Label for the IC is not valid for card constructions of other vendors who obtain the IC directly from the IC Vendor.

Section **2.4.3 #B420# Modular Certification – CQM Label Strategy** provides some guidance for vendors which approach to choose with respect to Modular Certification.

2.4.3 #B420# Modular Certification – CQM Label Strategy

As indicated in section **2.4.2 #B410# Modular Certification – Introduction**, CQM permits two different approaches for the Vendor of a CQM Product to ensure the required use of CQM certified components:

- The producer of the component applies for and obtains the required CQM Label for the component, or
- The Vendor of the CQM Product incorporating a component applies for and obtains the required CQM Label for the component.

To decide which of the two approaches:

- CQM Label applied for and obtained by the producer of the component, or
- CQM Label applied for and obtained by another entity, e.g. the card vendor procuring the component,

is better suited for a CQM vendor's situation depends on the following considerations:

Reasons for a component producer to obtain CQM labels for a CQM product themselves:

- the component producer intends to market the component to multiple CQM vendors
- the component producer develops and qualifies the product

- the component producer has defined the QCP
- the component producer produces the CQM product
- the component producer considers the product their intellectual property

Reasons for the component producer to not obtain CQM labels themselves:

- the component producer produces the component for a single CQM Vendor,
- the component's design and qualification is outside of the component producer's control,
- the Quality Control Plan ("QCP") the component producer follows is not primarily developed and maintained by the component producer but by the component producer's customer,
- the component producer acts as a subcontractor, meaning the component producer is paid for providing production services and not for providing the component.

If the majority of reasons supports the producer obtaining the CQM Labels themselves, then this is the highly recommended approach.

If the majority of reasons does not support the producer obtaining the CQM Label themselves, then CQM recommends that the producer and the purchaser agree on who obtains the CQM Label for the component.

Examples:

- An inlay manufacturer begins manufacturing antenna inlays for the production of dual interface cards in the banking card market. The inlay manufacturer should obtain the CQM Label for their inlay production.
- An IC packaging company is requested by a card producer to produce a special IC package (an "ICM") developed by the card producer to protect an IC embedded into an Interactive Card. The IC packaging company has no intention to market additional products in the banking card market, and the special package is developed and qualified by the card producer. The card producer should obtain the CQM Label for IC packaging.

2.4.4 #B430# CQM Products

CQM Products are card products and card components that have a corresponding CQM Label and are defined through a set of requirements in the CQM Assessment Plan.

CQM Products are defined in 1.7#A610# CQM Products, CQM Components, and CQM Variants.

CQM Products usually have variants, due to functional differences (e.g. contact, contactless interface), and due to differences in the production process and the supply chain, e.g. producing an IC Card from a card body and an IC Module ("mICC"), or producing the IC Card from an inlay already containing the IC ("ilICC").

CQM Variants are also defined in 1.7#A610# CQM Products, CQM Components, and CQM Variants. An actual physical card product can be, and often is, a combination of variants. For example, a dual interface IC Card produced from a card body ("CB")

containing an antenna inlay ("aIL"), and an IC Module ("ICM") containing the IC is a combination of the following CQM Variants:

- a kICC, an ICC with an ISO/IEC 7816-2 based contact interface
- a pICC, an ICC with an ISO/IEC 14443 based contactless interface
- a mICC, an ICC produced using an ICM containing the IC

CQM Variants are defined in section **3.2 #C200# Determining the applicable CQM Products**, subsections:

- **3.2.2 #C220# CQM Process Variants**
- **3.2.3 #C230# CQM Product Variants**

Vendors select the applicable Variants in the CQM Assessment Plan ("cqmAPl") in the worksheet "Audit Scope & Compliance".

2.4.5 #B440# CQM Labels

CQM Labels are based on CQM Products with some variants of the CQM Products, usually only interface variants are considered for the labels.

The following CQM Labels are defined:

CQM Product	CQM Label
IC	kIC with contact interface
	dIC – IC with dual interface, kIC+pIC
ICM	kICM – ICM with contact interface
	dICM – ICM with dual interface, kICM+pICM
iaICM	ICM containing additional components, e.g. discrete capacitors or resistors, or multiple IC.
IL	IL
CB	CB
ICC	kICC – ICC with contact interface
	dICC – ICC with dual interface, kICC+pICC
	mICC – ICC from ICM containing the IC
	ilICC – ICC from IL containing the IC
P	P – Personalization
iaICM	iaICM – iaICM without contact or contactless interface
	kiacICM – iaICM with contact interface
	diaICM – iaICM with dual interface
BSM	Biometric Sensor Module, a module similar to an ICM or an iaICM, containing a biometric sensor such as a fingerprint sensor, a voice sensor, or an image sensor

iacIL	iacIL – iacIL without contact or contactless interface
	kiacIL – iacIL with contact interface
	diacIL – iacIL with dual interface
IAC	kiAC – IAC with contact interface
	diAC – iacIL with dual interface

For the relation between CQM Labels and CQM Product Variants see 1.7#A610# CQM Products, CQM Components, and CQM VariantsError! Reference source not found..

2.4.6 #B450# Supply Chain Configurations

To receive CQM labels for certain CQM products the vendor must demonstrate that certain components the vendor uses to produce the CQM Product are CQM certified.

This section defines which components must be CQM certified so that the vendor may receive CQM labels for a specific CQM Product containing those components. To receive a CQM Label for a CQM Product the vendor of the CQM Product must demonstrate that the components shown in the diagrams below immediately to the left of the CQM Product to be certified have been CQM certified.

Each assumed Process Configuration is represented below by a diagram.

The Process Configurations introduced in this section are grouped into two sub-sections:

- **2.4.6.1 Process Configurations for 'Standard' single IC payment cards ("ICC")**, and
- **2.4.6.2 Process Configurations for InterActive Cards ("IAC")**.

Also see sectionError! Reference source not found. **2.4.4 #B430# CQM Products** for the defined CQM Labels and related CQM Variants.

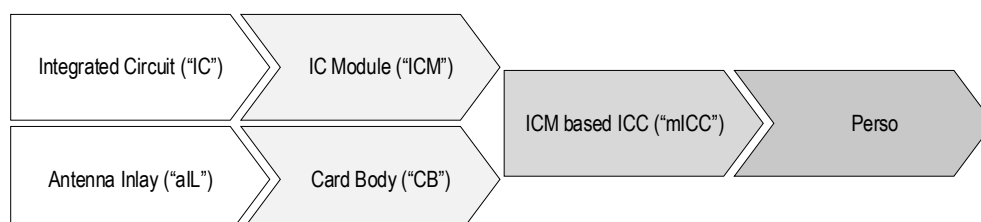
2.4.6.1 Process Configurations for 'Standard' single IC payment cards ("ICC")



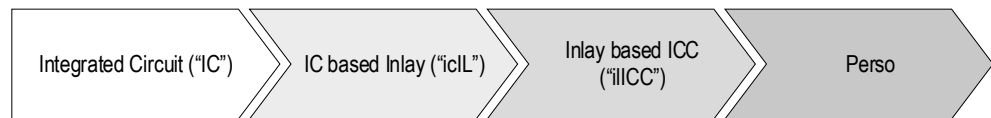
Note

The names of CQM Products defined in 2.4.4 #B430# CQM Products might in the charts below be preceded by one or two lower case letters to specify process variants specific to the Process Configuration. These process variants are explained in section 3.2.2 #C220# CQM Process Variants.

2.4.6.1.1 Produced using CB, and ICM containing the IC:



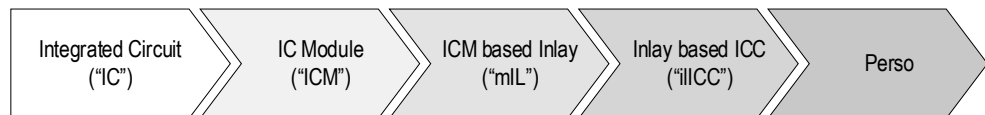
2.4.6.1.2 Produced using an IL containing the IC:



Note

In this scenario the ICC Process includes the applicable process steps normally assigned to CB, especially Printing the Mastercard logo and applying the magnetic stripe.

2.4.6.1.3 Produced using an IL containing an ICM containing the IC:

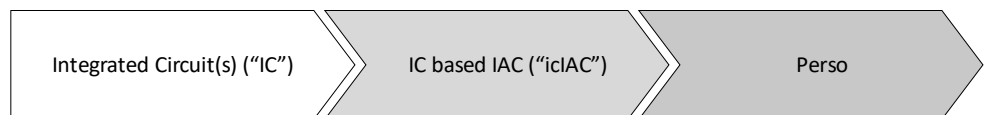


Note

In this scenario the ICC Process includes the applicable process steps normally assigned to CB, especially Printing the Mastercard logo and applying the magnetic stripe.

2.4.6.2 Process Configurations for InterActive Cards ("IAC")

2.4.6.2.1 IAC produced without an Interactive Card Inlay:



Note

In this scenario the IAC Process includes the applicable process steps normally assigned to ICM, including die/wire/flip-chip bonding, and CB, including printing the Mastercard logo, and applying the magnetic stripe.

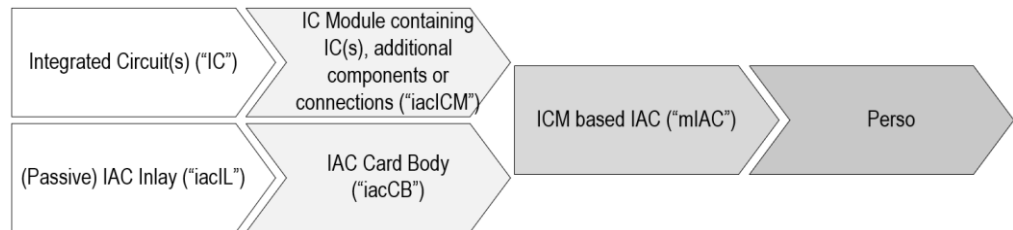
2.4.6.3 IAC produced with an Interactive Card Inlay, where the IC are directly contained in the IL, without interim packaging into an ICM:



Note

In this scenario the Process includes die/wire/flip-chip bonding; and the IAC Process includes the applicable process steps normally assigned to CB, including printing the Mastercard logo, and applying the magnetic stripe.

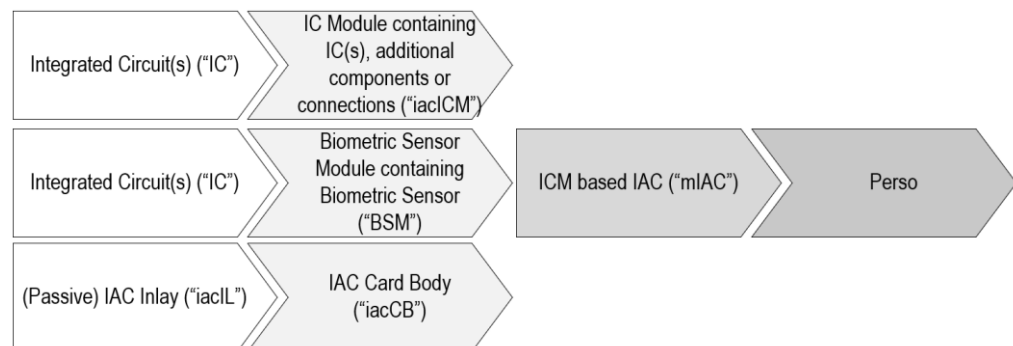
2.4.6.3.1 IAC produced with an Interactive Card Inlay, where the ICs are contained in an ICM:



Note

In this scenario the iacICM Process includes the process die/wire/flip-chip bonding; and the IAC Process includes the applicable process steps normally assigned to CB, including printing the Mastercard logo, and applying the magnetic stripe.

2.4.6.3.2 IAC produced using a passive Interactive Card Inlay an ICM containing the secure element (and optionally additional components or connections), and another ICM containing a biometric sensor:



Note

In this scenario both the iacICM Process and the BSM Process include the process die/wire/flip-chip bonding; and the IAC Process includes the applicable process steps normally assigned to CB, including printing the Mastercard logo, and applying the magnetic stripe.

2.5 #B600# Generating Guidelines for the Personalizer

Vendors supplying a CQM Product² to a Personalizer, who is an issuer or a contractor to the issuer, shall provide this Personalizer with Personalization Guidelines.

These Personalization Guidelines shall define a process for personalizing the functionality of the contact and contactless interface. Personalization Guidelines for every non-personalized CHD shall be developed and documented.

² The term Product here refers to every non-personalized Cardholder Device ("CHD")

The Personalization Guidelines are an integral part of the CQM Product, and they shall be provided to the Personalizer, along with the product.

2.6 #B700# Implementation Guidance

The following sections provide additional explanations to the implementation of and requirements resulting from the quality management requirements defined in chapter **4 Quality Management System Requirements**.

2.6.1 #B710# Product Identification and Definition

2.6.1.1 #B711# Introduction

Section **2.4.1 #B405# Introduction** defines that CQM assesses and certifies a vendor's ability to produce a specific CQM Product in a specific site.

To achieve CQM Certification, a vendor must determine first the applicable CQM Products from the list defined in section **2.4.4 #B430# CQM Products**, and then the applicable Process Variants defined from those defined in section **3.2.2 #C220# CQM Process Variants** and the applicable Product Variants from those defined in section **3.2.3 #C230# CQM Product Variants**.

The vendor defines the CQM Products and Process and Product Variants to be covered by the CQM Assessment and the CQM Labels in the CQM Assessment Plan ("cqmAP") in the worksheet "Audit Scope & Compliance".

To qualify for obtaining the CQM Label for a specific CQM Product, the vendor must demonstrate that the site producing the CQM Product complies with:

- The applicable QMS Requirements defined in section **4 Quality Management System Requirements** and listed in the worksheets "QMS - ..." in the cqmAP, either in the configuration applicable to vendors maintaining an ISO 9001 certificate, or in the configuration applicable to those not maintaining an ISO 9001 certificate, and
- The applicable Product Requirements defined in sections **5 IC Requirements - Requirements applicable to the component IC** to **14 Personalization - ID-1 Product Requirements**, as listed in the cqmAP worksheets corresponding to the CQM Product Names.

One of the main objectives the vendor must achieve on their way to CQM conformity is a specification of the product(s) the vendor wants to produce under the CQM Label(s).

A specification of a product defines all the characteristics the produced product must fulfil. The specification of a product must ensure that any product in the site can be easily identified and that its characteristics are well defined.

A product supplied is typically defined through two sets of information:

- Product specific information, which is typically independent of individual orders, and

- Order specific information, which is typically dependent on details of individual orders for customizing a product for a client.

The order independent information defining the product to be delivered by the Vendor is subsequently referred to as the "Product Specification", the order dependent information defining the remaining information to fully specify the product to be delivered is subsequently referred to as the "Order Specification".

Examples of information typically in a Product Specification for example are:

- CPU and memory configuration of an IC
- Encapsulation material, wire thickness, bond diagram for an ICM
- Type and thickness of core and overlay material for a CB
- Type of IC, ICM and antenna layout for an ICC
- CB and ICM for an ICC
- ICC for Personalization

Examples of information typically in an Order Specification are:

- Artwork to be printed for a CB

The definition of the product's characteristics shall address all relevant requirements defined in this document.

It is up to the Vendor to decide which part of these definitions are defined in an order independent Product Specification and which in an Order Specification, albeit CQM places a clear preference on standardized products and thus a maximization of the information contained in the Product Specification. Anyhow, CQM acknowledges that defining all information relating to a product to be delivered in a Product Specification might be impractical, e.g. the printed artwork of a card to be delivered. If the Vendor chooses to not completely define the product to be delivered in a Product Specification, the remnant of the mandatory definitions not addressed in the Product Specification shall be addressed in the Order Specification.

2.6.1.2 #B712# Product Specification

For the purpose of this document, the "Product Specification" is the entirety of information defining the product independent of an individual order. The structure of the Product Specification is up to the Vendor to define. The Product Specification may for example be a table simply listing requirements, a single document defining the product, a set of documents, or a set of records in a database.



Note

Chapter 3 "#C000# Determine the Applicable Requirements" provides guidance, which CQM Requirements, both Quality Management System Requirement and Product Requirements are applicable for a specific Vendor and product. Conformity to these requirements shall be part of the Vendor's Product Specification.

The Vendor shall assign the Product Specification a unique identifier and this identifier shall be traceable to every product the Vendor supplies as covered by a CQM Label.

If the Product Specification is intended to define a CHD or other product covered by a CQM Label, it shall clearly reference the CQM Product the CQM Label is intended to cover.

The Product Specification shall clearly identify the state of qualification/approval of the product/CHD it defines.

The Product Specification shall define or reference all requirements applicable to the product/CHD that are not defined in the Order Specification.

CQM recommends that the Vendor maximizes the information covered by the Product Specification and keeps the information covered by the Order Specification to a minimum.

The scope of the Product Specification shall be well defined, ensuring the product/CHD is described clearly in addition to the above, either through defining it in the Product Specification, or referencing other documents from the Product Specification as listed in section **4.8.3.5.2 #0501#**: *Design and Development – Product Specification*.

Where the product/CHD is part of a device providing non-Mastercard financial transaction functionalities, the Product Specification shall accurately define the interface between functions that relate to the CHD and other functions. The description of the interface shall define well how integrity and isolation of the functions and related components relevant to Mastercard are ensured.

2.6.1.3 #B713# Order Specification

For the purpose of this document, the "Order Specification" is the entirety of information necessary defining the product that is not defined in the related Product Specification.

If the Order Specification is complementary to a Product Specification, it shall clearly reference that Product Specification.

The Order Specification shall define or reference all requirements applicable to the CHD that are not defined in the Product Specification.

2.6.2 #B720# Quality Control Measures

2.6.2.1 #B721# Principle

The Vendor shall ensure the products the Vendor supplies conform to the Product Specification and the Order Specification.

To achieve this, the Vendor shall plan the quality of the product at at least three levels:

- Product Qualification, quality control measures at the end of the development stage, verifying that initial product samples meet all the applicable requirements

- Production quality control, quality control measures that verify that samples from regular production meet the applicable requirements. Usually these control measures are conducted on a sampling basis of production batches and address a subset of the requirements verified during qualification. Production quality control shall also address conformity to the requirements specified in the Order Specification.
- Quality monitoring, quality control measures that complement the Production quality control measures from time to time to verify samples from regular production continuously meet the applicable requirements. Usually these measures address from time to time conformity to those requirements that are not covered by Production quality control measures.

The Vendor shall plan these quality control measures in a Quality Plan consisting of three elements:

- Qualification Plan
- Production Quality Control Plan
- Quality Monitoring Plan

2.6.2.2 #B722# Qualification Plan

Requirements for the Qualification Plan are described in section **4.8.3.4.4 #0582#: Design and Development – Product Qualification Plan**.

2.6.2.3 #B723# Production Quality Control Plan

The Production Quality Control Plan (see **4.8.5.1 #0701#: Production and Service Provision – Control of Production and Service Provision, QCP**) shall list the tests conducted as product quality controls with at least the following details:

- Related production process step
- Related requirement from the Product or Order Specification
- Sampling parameters, e.g. number of samples, frequency of sampling
- Test method

2.6.2.4 #B724# Quality Monitoring Plan

The Quality Monitoring Plan shall follow the format of the Qualification Plan but in addition shall specify the frequency of sampling and the frequency of testing (if samples are not tested right away) for every test.

The Quality Monitoring Plan could be a part of the Production Quality Control Plan or a separate document.

2.6.3 #B730# Qualification

2.6.3.1 #B731# Qualification Process

Section **4.8.3.4.3 #0651#: Design and Development – Product Qualification Process** requires a Vendor to qualify its products, especially any product covered by a CQM Label.

Section **4.1.2 #D120# Product Life Cycle Quality Management** describes the interrelation of requirements around the Qualification of products and processes.

Qualification is the verification that a product (and its underlying processes) meet a defined set of requirements.

Within this document it is assumed that the Product Specification defines the applicable requirements for qualification of the product, which are then detailed in a Qualification Plan. Qualification is typically done by taking representative samples of a product and testing them to determine if their characteristics comply with the requirements defined in the Product Specification.

2.6.3.2 #B732# Qualification Plan

Section **4.8.3.4.4 #0582#: Design and Development – Product Qualification Plan** requires the Vendor to define a formal Qualification Plan for each product including at least:

- A clear reference to the applicable Product Specification.
- The product structure (modular or non-modular).
- The detailed requirements, including Mastercard specified and non-Mastercard specified requirements.
- For each requirement the test method, sampling parameters (sample sizes, pass/fail criteria).

2.6.3.3 #B733# Qualification Report

Following qualification of a product the Vendor shall provide the results in a Qualification Report, where for every requirement and test method listed in the Qualification Plan the Vendor lists:

- The result of each test, either directly or as a summary with a reference to the detail results
- The verdict, like "pass" or "fail".

2.6.3.4 #B734# Verification of Incoming Status

The Vendor shall ensure that all incoming products becoming components of new products are CQM certified by verifying the CQM Labels granted to the Vendor of such component. The Vendor shall also ensure that any incoming products or materials for the CHD conform to Mastercard rules and regulations, typically security devices like holograms and signature panels.

Section **4.8.4.2 #0604#: Control of externally provided processes, products and services – Type and extent of control** provides further details.

2.6.3.5 #B735# Change Management

Section **4.8.5.6 #0761#: Production and Service Provision – Control of Changes** requires the Vendor to properly manage changes to the product and underlying processes to ensure the changes do not result in the product becoming no longer compliant to the corresponding Product Specification.

To achieve this, the Vendor shall re-qualify a changed product following a Qualification Plan. The Vendor may either do a full qualification, e.g. based on the original Qualification Plan used to initially qualify the product, or the Vendor may use a Qualification Plan adjusted to the change and only addressing requirements that potentially have been affected by the change.

2.7 #B800# Requirement and Test Method Tags

To ease referencing throughout this document, and the finding of specific bits of information, Product Requirements and Test Methods have been assigned 'Tags'.

These Tags have been defined using the following rules:

2.7.1 #B810# QuickTag

With version 2.15 a new type of tag was introduced, called a "QuickTag", simply designed to find a specific requirement quickly through use of a search function.

The QuickTag consists of a 4-digit number enclosed by one # at each end, e.g. #1204#.

Each requirement and each test method have been assigned a unique QuickTag.

Any references to individual requirements or test methods defined in the CQM Requirements should be made using the QuickTag, and not the previously used tags, nor section or page numbers, as these may change when the document is revised.

2.8 #B900# Requirement Section Structure

The requirements defined in this document are sorted into various sections.

- "Parts" contain requirements and test methods related to specific CQM Products or groups of CQM Products
- Chapters contain either requirements or test methods related to specific CQM Products or groups of CQM Products
- For most Chapters, Subchapters containing requirements for a specific product or group of products for a specific interface (contact or contactless)

This results in the main structure of the requirement sections being as shown in the following table:

Chapter	Description
Part B: Quality Management System Requirements	
4 Quality Management System Requirements	<i>This chapter defines the requirements applicable to the Vendor's Quality Management System and which of these requirements are assumed to be satisfied by an ISO9001:2015 or later certificate and which have to be assessed during the CQM Audit.</i>
Part C: Product Requirements and Test Methods for the IC Vendor	
5 IC Requirements - Requirements applicable to the component IC	<i>This chapter defines the Product Requirements applicable to the Component IC.</i>
6 IC Test Methods – Test Methods applicable to the component IC	<i>This chapter defines the Test Methods applicable to the component IC.</i>
Part D: Product Requirements and Test Methods for the ICM Vendor	
7 ICM Requirements - Requirements applicable to the component ICM	<i>This chapter defines the Product Requirements applicable to the component ICM, some of which are also applicable to IL, , and IAC.</i>
8 ICM Test methods – Test methods applicable to the component ICM	<i>This chapter defines the Test Methods applicable to the component ICM, some of which are also applicable to IL, , and IAC..</i>
Part E: Product Requirements and Test Methods for the CB, ICC, AIL and PIL Vendor	
9 CB Requirements - Requirements applicable to the component CB	<i>This chapter defines the Product Requirements applicable to the component CB</i>
10 CB and ICC Requirements - Requirements applicable to the components CB, ICC	<i>This chapter defines the Product Requirements applicable to the components CB, ICC, and IAC.</i>

Chapter	Description
11 <i>ICC Requirements - Requirements applicable to the components ICC,</i>	<i>This chapter defines the Product Requirements applicable to the components ICC, and IAC, but not to the component CB.</i>
12 <i>IL – Requirements for inlays</i>	<i>This chapter defines the Product Requirements applicable to the component IL and , some of which are also applicable to ICC, and IAC.</i>
13 <i>ID-1 Test Methods – Test Methods applicable to the components IL, CB, ICC, iacIL, and IAC</i>	<i>This chapter defines the Test Methods applicable to the components IL, CB, ICC, iacIL, and IAC</i>
Part F: Requirements and Test Methods for the Personalizer	
14 <i>Personalization – ID-1 Product Requirements</i>	<i>This chapter defines the Product Requirement for the personalization of ID-1 sized products, such as CB, ICC, IAC, pICC, IAC.</i>
15 <i>Personalization – Test Methods</i>	<i>This chapter defines the Test Methods for the personalization of ID-1 sized products, such as CB, ICC, ICC, IAC.</i>

And for example, chapter **5 IC Requirements - Requirements applicable to the component IC** contains the following subchapters:

- **General – applicable to IC independent of the interface ("IC")**
- **Contact – applicable to IC having a contact interface IC ("KIC")**
- **Contactless – applicable to IC having a contactless interface ("PIC")**

2.9 #BA00# CQM Assessment Plans

Assessment Plans are defined in a separate Excel-file, called cqmAP [Version].xlsx.

The [Version], including the optional Revision counter, of the file containing the Assessment Plans to be used shall be the same as or later than the one of the CQM Requirements.

See section **2.3 #B300# Versions & Revisions** for an explanation of the structure of [Version].

There are two assessment plans for assessing conformity of the quality management system, one for Vendors whose quality management system is certified according to ISO 9001:2015 and one for those whose is not.

In addition, there is an assessment plan for each CQM Product, listing the applicable requirements and corresponding test methods as well as some minimum sampling requirements for qualification and production control/quality monitoring.

The full assessment plan for a Site consists of the relevant quality management system assessment plan plus the assessment plans for the relevant CQM Products.

The document CQMAssessmentPlan.xlsx is structured such that the Vendor can use a section for self-assessment and then the CQM Auditor another section for recording conformity.

2.10 #BB00# Interpretation of Test Results

Measurement results often need to be compared to specified limits to derive a pass or fail decision. This section defines a set of rules that should help find the correct decision.

2.10.1 #BB10# Rounding of Measurement Results

One case of confusion occurs when the measurement result has more digits after the decimal than the limit specified in the requirement, for example:

- Specified Maximum: 2.0
- Measurement: 2.001

The Measurement could be interpreted as being larger than the Specified Maximum and hence the evaluation of the result would be a fail. Anyhow, this would not be the correct way to evaluate the result.

In such case the Measurement shall be rounded to the same number of digits after the decimal as the requirement, using the 4/5 rounding rule.

In the example, therefor the Measurement shall be rounded to 2.0, and the result of the evaluation of the result is hence a pass.

2.10.2 #BB20# Consideration of Measurement Uncertainty

When evaluating a measurement result, the uncertainty of the measurement should be considered.

Measurement uncertainty consists of a group of factors:

- the accuracy of the measurement equipment
- human factors
- environmental factors



Note

The accuracy of a digital measurement equipment is usually larger than the resolution of its display, e.g. a digital micrometer with a 0.001 mm display resolution might only have an accuracy of 0.005 mm. The measurement equipment vendor usually provides the accuracy in the documentation.

A 3rd party laboratory providing measurement results intended to be used to determine conformity of CQM products shall always report the measurement uncertainty for each measurement. A 3rd party laboratory shall indicate measurements that due to the measurement uncertainty cannot be clearly decided as pass or fail as "Borderline". The 3rd party laboratory may use an equivalent term, as long as it is clearly distinct from the terms used to indicate pass or fail.

A vendor should be aware of the measurement uncertainty of a specific measurement the vendor conducts, and adequately consider it when evaluating a measurement result.

2.11 #BC00# Concepts to reduce testing effort

2.11.1 #BC10# Sampling Frequency "Set-up"

In older versions of the CQM Requirements sampling rates for controls were defined either as "number-of-samples/batch", or as "number-of-sample/unit-of-time". The use of "number-of-samples/batch" resulted in some unnecessarily frequent testing, namely where a characteristic is influenced by a machine setting and independent of the product processed by the machine. In such case the characteristic was retested each time a new product batch was fed into the machine, even though the machine settings were held constant, and hence no difference in performance was to be expected.

An example would be repeating the check of the tipping foil color after cards with a different artwork are inserted into an embossing machine, with no changes being made to the configuration and settings of the embossing machine. The tipping foil color simply cannot have changed, and the control is unnecessary.

To increase test efficiency therefor the control frequency "number-of-samples/set-up" was introduced.

A "set-up" is the state of the production equipment after the entirety of settings and configuration are configured in a certain well-defined way, until a setting or part of the configuration is changed again. Changing the processed products from one batch to another of identical, or sufficiently similar products while keeping the settings and configuration of the production equipment unchanged does not constitute a new set-up.

The different batches processed together using the same set-up are usually from the same product or at least from the same product family, as keeping all settings in the processing equipment constant requires products that are at least very similar.

A typical example where the sampling frequency "set-up" is relevant is the personalization of mixed lots of cards, consisting of multiple personalization batches from different card manufacturing batches, and often of cards with different artworks (though these

batches will be of very similar construction and are from the same product family). The mechanical and graphical personalization profiles of these different card batches are sufficiently similar to allow all of them to be personalized using one set of parameters and one configuration of the personalization system. To gain efficiency, these personalization batches with the similar personalization profiles are combined into a single mixed lot, often called a "Rainbow Lot", loaded together into the personalization machine, and processed using a single datafile. In personalization, the creation of such "Rainbow Lot" takes place at the data preparation stage and the operator of the personalization equipment cannot group card batches together into a "Rainbow Lot".

Another example is the monitoring of Wire Bond Pull Strength, where often IC of identical products but from multiple wafer batches are processed with machine settings and configuration being held constant, and hence this is considered a single set-up.

2.11.2 #BC20# Product Family

In older versions of the CQM Requirements different products were always required to be individually subjected for example to reliability monitoring, and vendors had no option to optimize monitoring if they had multiple very similar products. A typical example are different IC products that only differ in the amount of non-volatile memory.

To permit more efficient testing and monitoring the concept of Product Families was introduced into CQM.

A Product Family is a group of products that share a significant part of their specification, e.g. a family of IC products with the same CPU core, I/O circuitry etc. where the products only differ in the amount of volatile memory, or a group of ICC products that differ in the printed artwork and the software configuration of the contained IC, but are made of the same configuration of plastic layers, IC, and ICM construction.

It is up to the vendor to define what the vendor's Product Families are. The vendor is free to not use the concept of Product Family at all.

If a vendor decides to use the concept of Product Families, then the vendor shall specify the Product Family and the different Products that are members of this Product Family following the below rules:

- The common characteristics of the products shall be specified in a Product Family Specification.
- The different characteristics of the products shall be specified in Product Specifications.
- Each Product Specification shall contain a reference to the Product Family Specification.
- How to actually structure the various specifications into actual documents is up to the vendor to decide, eg the Product Family Specification and different Product Specifications may be contained in a single document in different chapters, or in different documents.

The primary use of Product Family within CQM is to optimize quality monitoring effort, eg for IC manufacturers having a range of products only differing in the amount of non-volatile memory, or a card manufacturer where a range of different card products only differ in the artwork.

When using the concept of Product Family for monitoring, special care shall be taken which controls are suitable to be only monitored on the Product Family basis, and which controls could be influenced by the differences between the Products that are members of the same Product Family.

2.12 #BD00# Verbal forms for expressions of provisions

When identifying provisions in this document as requirements (information something must comply with) or recommendations (information something is recommended to comply with), this document follows the definitions of ISO/IEC Guide 2, section "Verbal forms for expressions of provisions":

2.12.1 #BD10# Requirement

Verbal form	Equivalent phrases of expressions
shall	is to is required to it is required that must has to only ... is permitted it is necessary needs to
shall not	is not allowed / permitted / acceptable is required to be not is required that ... be not is not to be need not do not

2.12.2 #BD20# Recommendation

Verbal form	Equivalent phrases of expressions
should	it is recommended that ought to
should not	it is not recommended that ought not to

2.12.3 #BD30# Permission

Verbal form	Equivalent phrases of expressions
may	is permitted is allowed is permissible
need not	it is not required that no ... is required

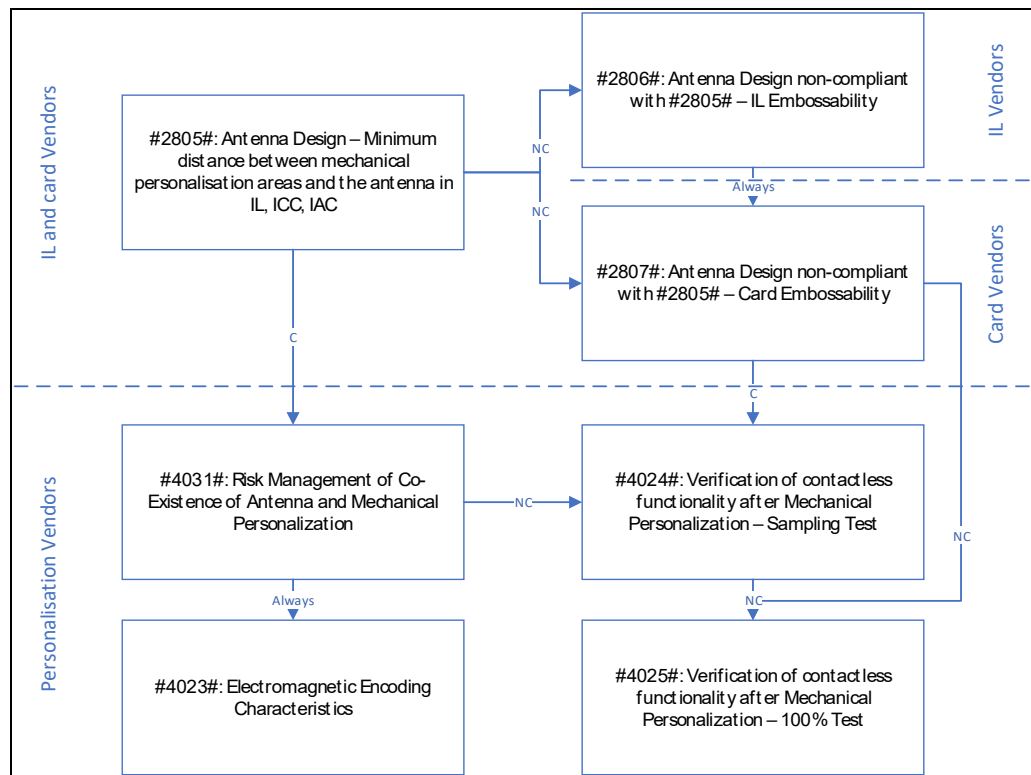
2.12.4 #BD40# Possibility and capability

Verbal form	Equivalent phrases of expressions
can	be able to there is a possibility of it is possible to
can not	be unable to there is no possibility of it is not possible to

2.13 #BE00# Verification of contactless functionality after mechanical personalization – relationship of CQM requirements

While IC, ICM, IL, and card vendors are required to verify contactless functionality of their contactless products at a rate of 100% before forwarding the product to subsequent manufacturing steps or another vendor, the sampling frequency after mechanical personalization depends on the level of conformity to a range of requirements, some within, and some outside of the control of the personaliser.

The following chart shows the various requirements regarding the verification of contactless functionality after mechanical personalization, their relationship, and which Vendor is responsible for which requirement:



Symbols used in the above chart have the following meanings:

- C: The requirement the arrow points to is applicable if the IL or card construction is conforming to the requirement the arrow points from.
- NC: The requirement the arrow points to is applicable if the IL or card construction is not conforming to the requirement the arrow points from.
- Always: The requirement the arrow points to is always applicable, independent of if the IL or card construction is conforming to the requirement the arrow points from.

3 #C000# Determine the Applicable Requirements

This chapter assists Card Vendors and Subcontractors in determining which of the quality management system requirements listed in chapter 4 and which of the product requirements listed in chapter 5 to 15 are applicable to the products the Vendor wants to submit to the CQM Assessment process.

3.1 #C100# Introduction 56

3.2 #C200# Determining the applicable CQM Products 56

3.2.1 #C210# Introduction to determining the applicable CQM Products 56

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3.4.2 #C420# Determine applicable Product Requirements 59

3.1 #C100# Introduction

The procedure for using this chapter is the following:

1. Determine the applicable CQM Products
2. Determine the applicable CQM Product Variants
3. Determine the applicable CQM Labels
4. Determine the applicable Optional Process Steps
5. Determine the applicable CQM requirements
6. Find the details on applicable requirements and test methods in chapters 4 to 15, implement them into processes and products, and subject them to CQM Assessment.

3.2 #C200# Determining the applicable CQM Products

3.2.1 #C210# Introduction to determining the applicable CQM Products

Section **2.4.4 #B430# CQM Products** defines the high level product structure underlying the CQM Label system and section **2.4.6 Configurations** defines how these CQM Products interrelate in the supply chain.

This high-level product structure is not sufficient to address differences of existing variants in the card market, differences that need to be considered when evaluating compliance with CQM Requirements and planning and conducting CQM Assessment.

Therefore CQM considers in addition to the basic CQM Products:

- Product Variants
- Process Variants

of the basic CQM Products.

To initiate the CQM Assessment the vendor must define:

- CQM Products
- CQM Process Variants
- CQM Product Variants
- Optional Process Steps

In the worksheet "Audit Scope & Compliance" of the CQM Assessment Plan ("cqmAP").

The following sections explain CQM Products, Product Variants, Process Variants, and Optional Process Steps:

Item	Defined in section
CQM Products	1.7 #A610# CQM Products, CQM Components, and CQM Variants

Item	Defined in section
CQM Products in different Supply Chain Configurations	2.4.6 #B450# Supply Chain Configurations
CQM Process Variants	3.2.2 #C220# CQM Process Variants
CQM Product Variants	3.2.3 #C230# CQM Product Variants

3.2.2 #C220# CQM Process Variants

CQM assumes that to produce a finished Card, a range of process steps are conducted in a certain configuration. These process configurations can differ between vendors and products, and are referred to as "CQM Process Variants" in this document.

Some of these CQM Process Variants can cause different requirements being applicable if the process steps or the sequence of process steps to produce the CQM Product differ, e.g. the IC Card production process flow where the IC was previously packaged into an IC Module ("ICM") differs significantly from one where the IC is directly embedded in the inlay. Similarly, the process flow of an IL producer only producing antenna inlays (without ICs) does not include IC interconnection process steps, while the process flow of an IL producer producing inlays with IC's already embedded does. Such differences must be considered when planning and executing CQM Assessment.

The Vendor shall define the actual process flow defined in the cqmAP in the product worksheets by identifying which process steps are part of the process flow subject to certification.

To enable the vendor's customers to verify that their CQM certified supply chain covers all the needed process steps, and to enable CQM Auditors to verify all needed process steps were covered by CQM Assessments, a Vendor shall communicate which Process Variants were included in their CQM Assessment to their customers in accordance with requirement **#0724#: Communication – Declaration and Information of CQM Compliance** upon request.

3.2.3 #C230# CQM Product Variants

In addition to the CQM Process Variants, a range of product variants are considered in CQM, subsequently called CQM Product Variants. CQM Process Variants and CQM Product Variants are collectively referred to as "CQM Variants" in this document.

All CQM Product Variants are defined in 1.7 #A610# CQM Products, CQM Components, and CQM Variants. The Vendor shall define the CQM Variants subject to CQM Assessment in the CQM Assessment Plan prior to the CQM Assessment in the worksheet "Audit Scope & Compliance".



Note

The below sections will soon be updated to reflect changes to the way CQM Subscopes and CQM Variants are addressed by the CQM Certificate.

The CQM Labels issued to the Vendor are specifically tied to the configuration the Vendor defined in the cqmAP. CQM Variants that were not declared to be assessed in the cqmAP are not included in the CQM Label, even if the specific CQM Label does not explicitly state that certain Variants are or are not covered by the CQM Label.

To enable the vendor's customers to verify that their CQM certified supply chain covers all the needed process steps, and to enable CQM Auditors to verify all needed process steps in the supply chain are covered by CQM Assessments, a Vendor shall communicate which Product Variants were included in their CQM Assessment to their customers in accordance with requirement **#0724#: Communication – Declaration and Information of CQM Compliance**.

3.3 #C300# Requirements

When designing, developing and producing a Cardholder Device ("CHD") that incorporates a Mastercard application, the CHD product characteristics shall meet certain requirements:

- CQM Product requirements defined in this document, and

Requirements defined in other Mastercard documents, and other documents.

Compliance with CQM Product requirements is subject to CQM Assessment and CQM Certification, while compliance with other requirements might be subject to other assessment and certification schemes operated and/or endorsed by Mastercard or other entities.

A Vendor designing, developing and producing a CHD that incorporates a Mastercard application shall operate processes in compliance with the CQM QMS requirements defined in this document. Other requirements may be applicable to the Vendor's processes but are not subject to CQM Assessment and Certification.

Thus, CQM addresses two classes of requirements:

- Quality Management System Requirements, applicable to the Vendor's processes; and
- Product Requirements, applicable to CQM Products

3.4 #C400# Determining the applicable Requirements

This section guides the Vendor in selecting the applicable requirements for their activity.

3.4.1 #C410# Determine applicable Quality Management System Requirements

All Quality Management System Requirements defined in section **4 Quality Management System Requirements** are applicable to every CQM certified Vendor, independent from the product the Vendor produces.

By default, conformity to all requirements defined in section **4 Quality Management System Requirements** shall be assessed as part of the CQM Audit.

Mastercard recognizes a valid certificate issued against ISO 9001 as evidence of conformity to those Quality Management Requirements from section **4 Quality Management System Requirements** that are indicated with 'Covered by ISO 9001: Yes' at the beginning of the requirement text. If the Vendor presents such certificate to the CQM Auditor prior to the audit, the CQM Auditor shall deem the Vendor's processes conform to these requirements.

For the purpose of this document, a valid (see note below) IATF 16949 certificate may be considered equivalent to an ISO 9001 certificate subject to the same conditions.



Note

Certificates shall have been issued by a certification/registration body accredited by a signatory of the IAF Memorandum of Understanding

3.4.2 #C420# Determine applicable Product Requirements

The requirements applicable for a specific Product Type are defined in the corresponding CQM Assessment Plan ("cqMAP").

In addition, a table at the beginning of the section of each Product Requirement defines which products the Product Requirement is applicable to.

The following table lists the various chapters containing Product Requirements for the different CQM Products and Components, but note that the CQMAPs define if a requirement is applicable to a specific product, and not the section a requirement is located in:

Section	Name
5	<i>IC Requirements - Requirements applicable to the component IC</i>
5.1	<i>General – applicable to IC independent of the interface ("IC")</i>
5.2	Contact – applicable to IC having a contact interface IC ("KIC")
5.3	<i>Contactless – applicable to IC having a contactless interface ("PIC")</i>
7	<i>ICM Requirements - Requirements applicable to the component ICM</i>
7.1	<i>General – applicable to ICM independent of the interface ("ICM")</i>
7.2	<i>Contact – applicable to ICM having a contact interface IC ("KICM")</i>
7.3	<i>Contactless – applicable to ICM having a contactless interface ("PICM")</i>

#C000# Determine the Applicable Requirements**#C400# Determining the applicable Requirements**

9	<i>CB Requirements - Requirements applicable to the component CB</i>
9.1	<i>General - applicable to all CB independent of the interface</i>
9.2	<i>Contactless – Requirements applicable to CB including antennae</i>
10	<i>CB and ICC Requirements - Requirements applicable to the components CB, ICC</i>
10.1	<i>General – Requirements applicable independent of the interface</i>
10.2	<i>Contactless – Requirements applicable to CB and ICC having a contactless interface</i>
11	<i>ICC Requirements - Requirements applicable to the components ICC,</i>
11.1	<i>General – Requirements applicable to all ICC independent of the interface</i>
11.2	<i>Contact – Requirements applicable to ICC having a contact interface</i>
11.3	<i>Contactless – Requirements applicable to ICC having a contactless interface</i>
12	<i>IL – Requirements for inlays</i>
14	<i>Personalization – ID-1 Product Requirements</i>

Part B

Quality Management System Requirements

4 Quality Management System Requirements

This chapter defines the requirements applicable to the Vendor's Quality Management System and which of these requirements are assumed to be satisfied by an ISO9001:2015 or later certificate and which have to be assessed during the CQM Audit.

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4.1 #D100# Introduction

4.1.1 #D110# CQM Requirements versus ISO 9001:2015

The requirements defined in this section have been structured following the requirement structure introduced in ISO 9001:2015.

The individual quality management system requirements in this section can consist of one or more of the following:

- Reference to an ISO 9001:2015 requirement
- CQM Supplement – additional provisions that apply in addition to the referenced ISO 9001:2015 requirement
- Requirement independent of ISO 9001:2015.

Beginning with this edition Mastercard requires that the vendor implements an ISO 9001:2015 based QMS, but Mastercard does not require the vendor to have this QMS certified as ISO 9001:2015 compliant.

4.1.2 #D120# Product Life Cycle Quality Management

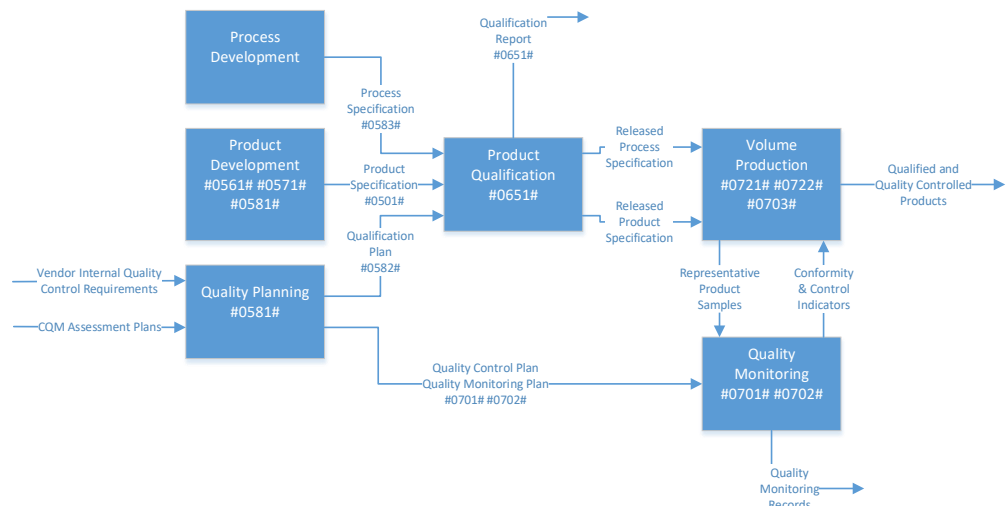
The main objective of the CQM Scheme is to ensure vendors manage adequately the quality of their products sold as a Mastercard branded cardholder device ("CHD"), or as a component thereof ("CQM Component"), throughout its lifecycle.

Vendors shall ensure that their product meets the applicable requirements before volume production begins ("Qualification"), while the product is produced in volume ("Monitoring"), until the product is no longer sold ("End-of-Life") as a Mastercard branded CHD, or as a component thereof:

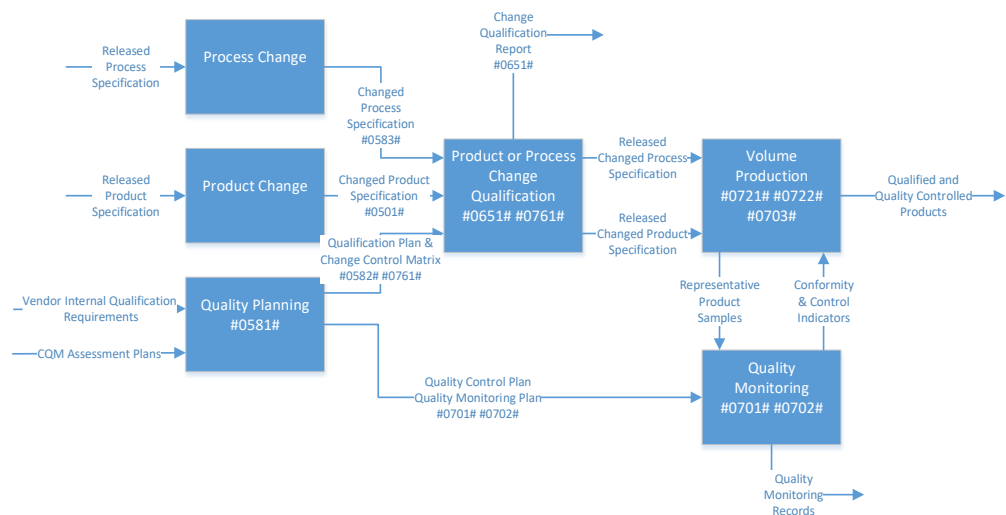


Note

The Tags in these process charts (4-digit numbers between #....#) refer to the related requirements. Additional QMS requirement may be applicable for the various processes.



Vendors shall in addition ensure that changes made to product or process do not adversely affect conformity of the product or component produced ("Change Control"):



4.1.3 #D130# CQM Quality Management System Requirements and ISO 9001

The internationally recognized ISO 900x Quality Management System family of standards promotes the adoption of a process-based approach for the operation of a quality management system. When this standard is adopted by an organization it enhances customer satisfaction by meeting customer requirements. This philosophy reflects the aims of the CQM Program.

The ISO 9000 standard provides general guidance on the philosophy of quality management and also contains the definitions most commonly used in relation to the subject. It also contains the seven management principles which provide the foundation for the ISO 9000 series of standards. These are:

- Customer focus

- Leadership
- Engagement of people
- Process approach
- Improvement
- Evidence-based decision making
- Relationship management.

These principles are not elements upon which an organization can be directly assessed but their influence can be seen throughout the standard, and as such, should be considered by any organization wishing to fully comply with the intent of the standard.

ISO9001:2015 provides a structured approach in that it defines seven elements that an organization must have in place to meet the standard:

- Context of the organization
- Leadership
- Planning
- Support
- Operation
- Performance evaluation
- Improvement

This structured approach to the management of a business reflects the aims of the CQM Program and it was for this reason that the ISO9001:2015 model was adopted for the CQM Requirements.

The requirements of the CQM Program have been linked directly to the clauses of the ISO 9001:2015 standard where applicable. However, the CQM Program does not require that an organization have a formalized quality management registration/certification, such as ISO 9001:2015 or IATF 16949. If an organization does have such registrations or certifications, then several of the requirements of the CQM Program will already have been met.

Requirements that will be assumed compliant during the audit are indicated in the heading of each requirement with "ISO 9001 Cert covers: ISO Requirement".

CQM defines requirements beyond ISO 9001, partially because ISO 9001 is by definition a generic standard and thus CQM can be more precise, as it has a much tighter and better-defined perimeter. Hence the CQM Audit shall address certain Quality Management System aspects even if the Vendor has a valid ISO 9001 certificate.

Beginning with the 2.17 Version of the CQM Requirements, provisions defined in ISO 9001 are not replicated in the CQM Requirements, but the respective section of the CQM Requirements simply refers to the applicable ISO 9001 requirement.



Note

Mastercard uses the term "Vendor" (as a general name) or "Card Vendor" (supplier providing cards to a personalizer). ISO9001 uses the term "organization", to mean any organization in a supply chain. In this document, the term "Vendor" is used in lieu of – and with equal meaning as – the term "organization" and can mean any organization within the CQM supply chain, unless explicitly stated otherwise.

4.1.4 #D140# Subcontracting of production of CQM Components

By default, CQM requirements assume that the entity owning a CQM Component is also producing it, and acts as the Vendor of the CQM Component within the CQM Certification Scheme. This means that the entity developing, specifying, and qualifying the CQM Component, and defining the Quality Control Plan for quality controlling production of the CQM Component, is also the entity producing the CQM Component.

While this approach covers most cases, there have been cases where this concept does not apply, and the entity developing, specifying, and qualifying the CQM Component, and defining the Quality Control Plan for quality controlling production is not themselves producing the CQM Component, but is subcontracting production of their product to a Subcontractor. This situation applies to some cases of Antenna Inlay production, and is becoming more common with the more complex supply chains of InterActive cards.

Such Subcontractor follows instructions provided by their customer when producing a product for their customer. The Subcontractor is not necessarily following requirements applicable if they were acting as the Vendor of the CQM Component, for example CQM Requirements, simply because the Subcontractor is asked by their customer to produce an item following instructions given by their customer, and the Subcontractor might not even be aware that the item produced is for a specific market, for example for inclusion into a Mastercard cardholder device. Also, the applied quality controls to produce this CQM component will follow the instructions provided by the Subcontractor's customer, and may, and often do, deviate from the quality controls the Subcontractor executes for the CQM Components the Subcontractor owns and markets themselves, as well as from the quality controls applied to CQM Components the Subcontractor produces for other customers.

Hence, within the CQM Scheme, this requires special consideration, as compliance of the CQM Component produced by the Subcontractor cannot be assumed, even if the Subcontractor is CQM certified to produce equivalent CQM Components the Subcontractor themselves develops, specifies, and qualifies, and defines and controls the Quality Control Plan.

With respect to the entity employing the Subcontractor, it must ensure, and demonstrate during the entity's CQM Audit, that all activities, including those executed by the Subcontractor, are conducted in compliance with the applicable CQM requirements.

The requirements applicable in this case are defined in the following CQM requirements:

- **#0606#: Subcontracted manufacturing of CQM Components – Introduction**

- ***#0607#: Subcontracted manufacturing of CQM Components – CQM certified Subcontractors***
- ***#0608#: Subcontracted manufacturing of CQM Components – Subcontractors not CQM certified***

4.2 #D200# Requirement Structure

Differing from previous editions of the CQM Requirements many of the QMS requirements in this edition refer to ISO 9001:2015 where conformity with ISO 9001:2015 is required, instead of more or less replicating the text from ISO 9001:2015.

In addition, specific additional provisions may be defined in these QMS requirements that apply in addition to the provisions in ISO 9001:2015; in such case these additional provisions are defined in a sub-section called "CQM Supplement".

Some of the QMS requirements defined in this document have no direct counterpart in ISO 9001:2015; in this case there is no sub-section called "CQM Supplement", as all the information defined in that section is a CQM Requirement.

The Header Table at the start of each requirement section specifies if only the ISO 9001:2015 requirement is applicable, or the ISO 9001:2015 requirement plus the CQM Supplement, or only the CQM Requirement.

4.3 #D300# Header Tables

A Header Table at the beginning of each QMS Requirement provide some information about the requirement and defines:

- If CQM requires to comply with only the ISO requirement text, with both the ISO requirement and the CQM Supplement text, or only the CQM Requirement text;
- If an ISO 9001:2015 certificate shall be considered by the CQM Auditor as evidence for the vendor's QMS being conform with this ISO 9001:2015 requirement.

4.4 Context of the organization

4.4.1 #0111#: Understanding the organization and its context

CQM Tag	#0111#
CQM Requirement	4.4.1 Understanding the organization and its context
ISO 9001 Requirement	4.1 Understanding the organization and its context
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.4.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.4.2 #0112#: Understanding the needs and expectations of interested parties

CQM Tag	#0112#
CQM Requirement	4.4.2 Understanding the needs and expectations of interested parties
ISO 9001 Requirement	4.2 Understanding the needs and expectations of interested parties
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.4.2.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.4.3 #0113#: Determining the scope of the quality management system

CQM Tag	#0113#
CQM Requirement	4.4.3 Determining the scope of the quality management system
ISO 9001 Requirement	4.3 Determining the scope of the quality management system
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.4.3.1 CQM Supplement

The Vendor shall include ISO 9001 section "8.3 Design and development of products and services" in the scope of the Vendor's management system.

Design activities sometimes erroneously not considered design activities by some vendors include:

- New card design, including the related internal and external qualification activities,
- Change of IC in an IC Card,
- A modified antenna for a card with contactless communication abilities,
- New production or test equipment, even if of a type previously installed in the production,
- New personalization profile, including its physical and logical aspects, including the related internal and external qualification activities.

Vendors shall manage such activities in conformity with the applicable CQM and ISO requirements, including adequate specification and qualification processes.

4.4.4 #0114#: Management System and Processes

CQM Tag	#0114#
CQM Requirement	4.4.4 Management System and Processes
ISO 9001 Requirement	4.4 Quality management system and its processes
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.4.4.1 CQM Supplement

The vendor shall document systematically the relevant processes underlying to the design and production of CQM Products.

The vendor may choose the means of documenting these processes, e.g. procedural instructions, flow or process charts, training documents in PowerPoint®, interlinked HTML documents, etc.

4.5 Leadership

4.5.1 Leadership and commitment

4.5.1.1 #0211#: Leadership and commitment – General

CQM Tag	#0211#
CQM Requirement	4.5.1.1 Leadership and commitment – General
ISO 9001 Requirement	5.1.1 General
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.5.1.1.1 CQM Supplement

The vendor shall define process owners who are responsible for managing the organization's processes and related outputs. Process owners shall understand their roles and be competent to perform these roles. See **#0461#: Competence**.

4.5.1.2 #0212#: Leadership and commitment – Customer focus

CQM Tag	#0212#
CQM Requirement	4.5.1.2 Leadership and commitment – Customer focus
ISO 9001 Requirement	5.1.2 Customer focus
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.5.1.2.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.5.2 Policy

4.5.2.1 #0221#: Establishing the quality policy

CQM Tag	#0221#
CQM Requirement	4.5.2.1 Establishing the quality policy
ISO 9001 Requirement	5.2.1 Establishing the quality policy
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.5.2.1.1 CQM Supplement

The vendor's quality policy shall include a commitment to comply with CQM Requirements, either directly by referencing CQM, or at least indirectly by referencing "applicable industry standards".

The vendor's quality policy shall include a commitment to Personnel motivation.

4.5.2.2 #0222#: Communicating the quality policy

CQM Tag	#0222#
CQM Requirement	4.5.2.2 Communicating the quality policy
ISO 9001 Requirement	5.2.2 Communicating the quality policy
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.5.2.2.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.5.3 #0231#: Organization – Organizational roles, responsibilities and authorities

CQM Tag	#0231#
CQM Requirement	4.5.3 Organization – Organizational roles, responsibilities and authorities
ISO 9001 Requirement	5.3 Organizational roles, responsibilities and authorities
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	Nothing

4.5.3.1 CQM Supplement

The role, responsibility and authority of each function within the Vendor's organization shall be defined, documented and communicated to all parts of the Vendor. This is typically achieved via "job descriptions".

All people responsible for carrying out a function within the Vendor shall be identified and made known to those affected by that function. This is typically achieved via organizational diagrams showing the names of the different functions and the names of the people holding those functions.

The requirements above shall especially cover personnel who need the organizational freedom and authority to:

- Manage and ensure CQM, other regulatory, and customer requirements are met.
- Initiate action to prevent the occurrence of any nonconformity relating to the CQM requirements.
- Identify and record problems relating to CQM Products.
- Initiate, recommend or provide solutions through designated channels.
- Verify the implementation of solutions.
- Control further processing, delivery or installation of nonconforming product until the deficiency or unsatisfactory condition has been corrected.

4.5.3.2 #0233#: Organization – CQM Primary Contact

CQM Tag	#0233#
CQM Requirement	4.5.3.2 Organization – CQM Primary Contact
ISO 9001 Requirement	5.3 Organizational roles, responsibilities and authorities
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall identify a person acting as the "CQM Primary Contact" towards the CQM bodies. The CQM Primary Contact shall have access to the Vendor's top

management level. In case, the Primary Contact is not available for more than seven sequential days a "CQM Secondary Contact" shall be named.

4.5.3.3 #0234#: Organization – Complaints Handling Responsibility

CQM Tag	#0234#
CQM Requirement	4.5.3.3 Organization – Complaints Handling Responsibility
ISO 9001 Requirement	5.3 Organizational roles, responsibilities and authorities
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The CQM Primary Contact shall be entitled to handle complaints related to the compliance of the Vendor's products and services with the CQM Requirements. The Vendor's management shall ensure the CQM Primary Contact is sufficiently competent.

The Vendor shall define the responsibilities for the handling of customer complaints.

The use of a formalized methodology to process complaints, such as the 8D problem solving methodology is highly recommended.

4.5.3.4 #0235#: Organization – Define Vendor/Customer Interface

CQM Tag	#0235#
CQM Requirement	4.5.3.4 Organization – Define Vendor/Customer Interface
ISO 9001 Requirement	5.3 Organizational roles, responsibilities and authorities
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

4.5.3.4.1 CQM Supplement

The responsibilities and tasks of personnel having direct contact with customers shall be defined. These personnel shall have appropriate qualifications.

4.5.3.5 #0236#: Organization – Define Responsibilities for Managing the Order Flow

CQM Tag	#0236#
CQM Requirement	4.5.3.5 Organization – Define Responsibilities for Managing the Order Flow
ISO 9001 Requirement	5.3 Organizational roles, responsibilities and authorities
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.5.3.5.1 CQM Supplement

The Vendor shall define the responsibilities for managing the order flow and the related interfaces between the Vendor and customers.

4.6 Planning the Quality Management System

4.6.1 #0310#: Planning – Actions to address risks and opportunities

CQM Tag	#0310#
CQM Requirement	4.6.1 Planning – Actions to address risks and opportunities
ISO 9001 Requirement	6.1 Actions to address risks and opportunities
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.6.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.6.1.2 #0585#: Planning – Risk Management (pFMEA, dFMEA etc)

CQM Tag	#0585#
CQM Requirement	4.6.1.2 Planning – Risk Management (pFMEA, dFMEA etc)
ISO 9001 Requirement	6.1 Actions to address risks and opportunities
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall establish, document and maintain a system for Risk Analysis and Management.

The Vendor shall determine and use tools, information and procedures to detect, evaluate, and manage risks.

This should include but is not limited to:

- Risk analysis
- Product FMEA ("dFMEA", "Design FMEA")
- Process FMEA ("pFMEA")
- Problem solving teams
- Training measures
- Incentive systems for improvement ideas

4.6.2 #0311#: Planning – Quality objectives and planning to achieve them

CQM Tag	#0311#
CQM Requirement	4.6.2 Planning – Quality objectives and planning to achieve them
ISO 9001 Requirement	6.2 Quality objectives and planning to achieve them
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.6.2.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.6.3 #0312#: Planning – Planning of changes of the Quality Management System

CQM Tag	#0312#
CQM Requirement	4.6.3 Planning – Planning of changes of the Quality Management System
ISO 9001 Requirement	6.3 Planning of changes
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.6.3.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.7 Support

4.7.1 Resources

4.7.1.1 #0411#: Resources – General

CQM Tag	#0411#
CQM Requirement	4.7.1.1 Resources – General
ISO 9001 Requirement	7.1.1 Support - Resources - General
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.7.1.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.7.1.2 #0421#: Resources – People

CQM Tag	#0421#
CQM Requirement	4.7.1.2 Resources – People
ISO 9001 Requirement	7.1.2 Support - Resources - People
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.7.1.2.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.7.1.2.2 #0422#: Resources – People – Human Resources for Design and Development

CQM Tag	#0422#
CQM Requirement	4.7.1.2.2 Resources – People – Human Resources for Design and Development
ISO 9001 Requirement	7.1.2 Support - Resources - People
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

4.7.1.2.3 CQM Supplement

The Vendor shall provide qualified personnel with appropriate skills (as required) for the design and development of new (including modified, changed, reconfigured) products with adequate skills. Skills may include technical, statistical and assessment knowledge and methodology as well as organizational and project management experience.

Interfaces between all entities involved in a design and development project shall be clearly defined.

4.7.1.3 #0431#: Resources – Infrastructure

CQM Tag	#0431#
CQM Requirement	4.7.1.3 Resources – Infrastructure
ISO 9001 Requirement	7.1.3 Infrastructure
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.7.1.3.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.7.1.4 #0433#: Resources – Environment for the operation of processes

CQM Tag	#0433#
CQM Requirement	4.7.1.4 Resources – Environment for the operation of processes
ISO 9001 Requirement	7.1.4 Environment for the operation of processes
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	Nothing

4.7.1.4.1 CQM Supplement

The vendor shall maintain its premises in a state of order, cleanliness, and repair that is consistent with the product and manufacturing process needs.

4.7.2 #0432#: Resources – Physical Security

CQM Tag	#0432#
CQM Requirement	4.7.2 Resources – Physical Security
ISO 9001 Requirement	
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

4.7.2.1 CQM Supplement

The Vendor shall be GVCP certified unless the Vendor is not required by Mastercard to be GVCP certified.

At the time this document is published, GVCP certification is not required for IC, ICM, and IL vendors.

4.7.2.2 Monitoring and measuring resources

4.7.2.2.1 #0441#: Monitoring and measuring resources – General

CQM Tag	#0441#
CQM Requirement	4.7.2.2.1 Monitoring and measuring resources – General
ISO 9001 Requirement	7.1.5.1 Monitoring and measuring resources - General
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.7.2.2.1.1 CQM Supplement

The vendor shall implement a monitoring and measurement infrastructure (equipment, personnel, documented instructions, forms) compliant with the applicable CQM requirements.

4.7.2.2.2 #0442#: Monitoring and measuring resources – Measurement traceability

CQM Tag	#0442#
CQM Requirement	4.7.2.2.2 Monitoring and measuring resources – Measurement traceability
ISO 9001 Requirement	7.1.5.2 Monitoring and measuring resources - Measurement traceability
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.7.2.2.2.1 CQM Supplement

The Vendor shall consider measurement traceability and the related requirements defined in ISO 9001 section "Measurement Traceability" applicable to the test and control equipment needed and used to determine conformity with the CQM Requirements.

The Vendor shall in addition to these requirements:

- Ensure inspection, calibration and/or maintenance is executed and documented by sufficiently qualified personnel.
- Define and maintain corrective procedures in case equipment or installations are found to be noncompliant during inspection, calibration and/or maintenance.
- Maintain records about inspection, calibration and/or maintenance. These records shall contain:
 - Identification of equipment or installation
 - Date of inspection, calibration and/or maintenance
 - Work conducted
 - Technical status or result of inspection, calibration and/or maintenance
 - Date of next inspection, calibration and/or maintenance
 - Identification of person who has performed inspection, calibration and/or maintenance.

The inspection, calibration and/or maintenance status shall be visible at the equipment and/or installation where appropriate. Other means of preventing the use of equipment or installations not sufficiently inspected, calibrated and/or maintained may be used.

4.7.2.3 #0451#: Organizational Knowledge

CQM Tag	#0451#
CQM Requirement	4.7.2.3 Organizational Knowledge
ISO 9001 Requirement	7.1.6 Organizational Knowledge
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.7.2.3.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.7.3 #0461#: Competence

CQM Tag	#0461#
CQM Requirement	4.7.3 Competence
ISO 9001 Requirement	7.2 Competence
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.7.3.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.7.4 #0462#: Awareness

CQM Tag	#0462#
CQM Requirement	4.7.4 Awareness
ISO 9001 Requirement	7.3 Awareness
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.7.4.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.7.5 #0481#: Communication

CQM Tag	#0481#
CQM Requirement	4.7.5 Communication
ISO 9001 Requirement	7.4 Communication
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	Nothing

4.7.5.1 CQM Supplement

The Vendor shall establish, document and maintain a system to control the information flow throughout the organization. This system shall ensure that personnel have access to all necessary information and unnecessary information is avoided.

4.7.5.2 #0724#: Communication – Declaration and Information of CQM Compliance

CQM Tag	#0724#
CQM Requirement	4.7.5.2 Communication – Declaration and Information of CQM Compliance
ISO 9001 Requirement	7.4 Communication
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

A CQM certified Vendor shall provide a copy of its CQM Certificate to their customers upon request.

In addition, to enable their customers to verify that their customer's CQM certified supply chain covers all the needed process steps, and to enable CQM Auditors to verify all needed process steps are covered, a Vendor shall communicate to their customers which Product and Process Variants and Optional Process Steps were included in their CQM Assessment. This is typically achieved by the Vendor providing to their customer upon request a copy of the cqmAP worksheet "CQM CoC", unless the Vendor is willing to provide the complete cqmAP.

A CQM certified Vendor shall explicitly communicate to at least those customers that have requested a CQM Certificate from the Vendor during the preceding 5 years, when a product or service provided to the customer is CQM compliant. A product or service is CQM compliant if the Vendor has successfully verified through testing both at qualification stage and through quality monitoring activities such as process controls and testing of product samples that the product conforms to the applicable CQM requirements, and it was manufactured exclusively in sites certified for the underlying CQM activities. The vendor should preferably communicate this through a statement in the product specification or through an addendum to the product specification, but may communicate this through other means, provided that the confirmation of the product's CQM conformity is given to the customer in a form the customer can store and retrieve reliably and the Vendor cannot easily repudiate; e.g. a signed physical or electronic letter but not simply a statement on a website.

If a product that was previously declared CQM compliant is no longer conform, or is no longer produced exclusively in sites covered by the relevant CQM Labels, then the Vendor shall inform their customer accordingly without delay.

The vendor shall maintain traceability of any product shipped to a customer that the vendor has declared CQM compliant. The product's status of CQM compliance, and any supporting records such as qualification, process control, and product testing records shall be traceable from article numbers, serial numbers, lot numbers or delivery and shipping information. Traceability of these records shall be maintained for the period required in **#0482#: Documented Information**.



Note

A recommended way of ensuring a Vendor informs its customers adequately as required in this section is providing a Certificate of Conformity related to each shipment, stating that the shipped products have been found conform to the applicable CQM Requirements, were tested in line with the CQM Assessment Plans reviewed by the CQM Auditor, and were manufactured exclusively in sites covered by valid CQM Labels, identifying the individual CQM Labels.

For personalization it is recommended to provide a Certificate of Conformity related to a time interval, as shipments from personalization can occur almost continuously.

4.7.6 #0482#: Documented Information (includes Record Retention)

CQM Tag	#0482#
CQM Requirement	4.7.6 Documented Information (includes Record Retention)
ISO 9001 Requirement	7.5 Documented Information
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	Nothing

4.7.6.1 CQM Supplement

The vendor shall consider all documents and records related to conformity of the Vendor's products and services with the CQM Requirements "Documented information" in the sense of ISO 9001:2015 section "Documented Information"

The vendor shall document systematically the relevant processes underlying to the design and production of CQM Products.

The vendor may choose the means of documenting these processes, e.g. procedural instructions, flow or process charts, training documents in PowerPoint®, interlinked HTML documents, etc.

Control of Documented Information shall include the identification and management of different versions of Documented Information, and the retention of outdated Documented Information for the period defined below for Quality Records.

The Vendor shall establish a master list of all valid types of Documented Information for identifying the current status of version and revision and make it accessible to all relevant personnel.

If documents are managed and distributed electronically through a document control system and not in form of printed copies, and this document control system ensures that only the valid version of a document is clearly identifiable as the only valid version and withdrawn and outdated documents are clearly identifiable as such or not at all available, then the master list shall be deemed established as de facto it is established inside the document control system.

The Vendor shall define responsibilities and procedures for editing, reviewing, approving, releasing and changing Documented Information; and that changes of parts of a document or of an entire document are recorded and marked in each copy (where practicable).

The Vendor shall take special care that staff working in secure production environments can access the Documented Information relevant for their functions.

The Vendor, as part of the approval process of Documented Information, shall determine the necessary actions to amend the Competence of personnel affected by the change.

For Documented Information containing evidence of conformity of products to CQM Requirements (previously called "Quality Records") the Vendor shall define for each type the retention period (time the record is kept after completion) depending on the life time of a product or component, legal aspects, Governmental, customer and CQM requirements, with a minimum retention period of 3 years or the expected end of life of the issued cards or CHDs, whichever comes earlier.

The vendor shall maintain a Quality Manual with the subsequent minimum content:

- The scope of the quality management system, including details of and justification for any exclusions;
- Documented processes established for the quality management system, or reference to them;
- The organization's processes and their sequence and interactions (inputs and outputs), including type and extent of control of any outsourced processes;

The Vendor shall maintain a Master List of the different types of Documented Information containing evidence of conformity of products to CQM Requirements.

Documented Information containing evidence of conformity of products to CQM Requirements stored electronically shall be backed-up regularly depending on its relevance to the business.

Documented Information no longer used or stored by the Vendor shall be disposed in a controlled way, ensuring such Documented Information does not become accessible without appropriate authorization, e.g. as a result of inappropriate means of disposal.

4.8 Operation

4.8.1 #0580#: Operational Planning and Control

CQM Tag	#0580#
CQM Requirement	4.8.1 Operational Planning and Control
ISO 9001 Requirement	8.1 Operational planning and control
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.1.1 #0583#: Operational Planning and Control – Process Specification

The vendor shall specify the process flow and all relevant parameters in a Process Specification, covering:

- Definition of all points of electrical interaction with the IC
- Identification of all critical process steps
- Definition of all critical process parameters, e.g. in parameter sheets, unless these parameters are order specific
- For order specific process parameters, mechanisms to define them, to communicate them to relevant parts of the Vendor's organization, and record them for traceability purposes
- Definition of all the inputs to the process (components including CQM Components, materials, equipment)
- Definition of the output to the process, e.g. the CQM Product

A Process Specification can consist of multiple different documents and formats, such as:

- Process Flow
- Control Plan
- Work Instructions
- Test Instruction
- Parameter sheets

The vendor shall make the information contained in the Process Specification available to their relevant staff, such that the staff has knowledge of the relevant information to conduct the processes in a repeatable and well-defined manner.

4.8.1.2 #0584#: Operational Planning and Control – Process Control Plan

The Vendor shall develop, implement and maintain a Production Process Control Plan including:

- Process Parameters
- Control method, sample size, and frequency
- Process-related special characteristics
- Machines, jigs, fixtures, tools for manufacturing
- Verification of job set-up
- Reaction plans, corrective actions
- Maintenance and tooling management, including scheduling
- Work instructions

4.8.1.3 #0652#: Operational Planning and Control – Process Qualification Process

CQM Tag	#0652#
CQM Requirement	4.8.1.3 Operational Planning and Control – Process Qualification Process
ISO 9001 Requirement	8.1 Operational planning and control
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall qualify its production processes and production lines for volume production before they are used for the manufacturing of a CQM Product, according to a documented procedure.

The Vendor's Process Qualification Process shall ensure that prior to utilizing a new or modified production process for volume production of CQM Products and components:

- The production process is well specified;
 - Equipment
 - Workflow
 - Control steps
 - Critical process parameters, their limits, and permitted tolerances, and where operators are permitted to adjust process parameters without re-qualifying the process, the range within which operators may make such adjustments
- The following CQM requirements are met by the new or modified production process:
 - **#0722#: Production and Service Provision – Product Traceability**
 - **#0723#: Production and Service Provision – Process Traceability**

The Vendor shall define in a Process Qualification Plan for the qualification of the new or modified production process:

- Production performance targets
- Qualification and release mechanisms
- Process validation techniques.
- Product characteristics that might be affected by the modification to the production process and hence require verification



Note

The vendor may not simply assume that two pieces of manufacturing equipment perform identically, or that they operate correctly with the same parameters, just because they have the same model number and look identically.

The Vendor shall document the results of the Process Qualification in a Process Qualification Report in accordance with **#0653#: Operational Planning and Control – Process Qualification Report**

The Vendor shall only deploy production processes that have been proven to reproduce products that are equivalent in their performance and reliability.

4.8.1.4 #0653#: Operational Planning and Control – Process Qualification Report

CQM Tag	#0653#
CQM Requirement	4.8.1.4 Operational Planning and Control – Process Qualification Report
ISO 9001 Requirement	8.1 Operational planning and control
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

For changes to the production process, such as:

- A new production process,
- A modified production process,
- Deployment of a new piece of production equipment,
- Changes to production parameters outside of previously qualified production parameter ranges

the Vendor shall qualify the new or modified production process in accordance with **#0652#: Operational Planning and Control – Process Qualification Process**, and document the result in a Process Qualification Report, documenting at least:

- Process specification (see **#0583#: Operational Planning and Control – Process Specification**), defining the process flow, including production and control stages, e.g. by referencing the documented information specifying the process
- Conformity to **#0723#: Production and Service Provision – Process Traceability**,
- Critical process parameters and limits,
- Production performance targets achieved,
- Qualification and release mechanisms utilized
- Process validation techniques utilized,
- And where the process is primarily qualified by qualifying the process' output, a product qualification report in addition with **#0654#: Design and Development – Product Qualification Report**

4.8.2 Requirements for Products and Services

4.8.2.1 #0661#: Requirements for Products and Services – Customer Communication

CQM Tag	#0661#
CQM Requirement	4.8.2.1 Requirements for Products and Services – Customer Communication
ISO 9001 Requirement	8.2.1 Customer Communication
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.2.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.2.2 #0662#: Requirements for Products and Services – Determining the Requirements for Products and Services, Order Specification

CQM Tag	#0662#
CQM Requirement	4.8.2.2 Requirements for Products and Services – Determining the Requirements for Products and Services, Order Specification
ISO 9001 Requirement	8.2.2 Determining the requirements for products and services
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement
Changelog:	
After V2.22	Editorial changes only: Order Specification appended to title to clarify that an Order Specification is required, verbiage added to clarify Order Specification

4.8.2.2.1 CQM Supplement

The Vendor shall document the requirements for products and services in an Order Specification.

The Order Specification shall specify information specific to an individual order (including frame contracts), and also contain a reference to more generic information needed to execute the order such as the specification of the underlying product (see **#0501#: Design and Development – Product Specification** and **#B710# Product Identification and Definition**) and production processes.

The Order Specification shall specify or reference all information necessary to complete an order, including but not limited to:

- Materials and components
- Machine programs and parameter sheets
- Test and control programs and their settings



Note

Barcodes on products, components, and on documents are considered references in the scope of this requirement.

4.8.2.3 #0663#: Requirements for Products and Services – Review the Requirements for Products and Services

CQM Tag	#0663#
CQM Requirement	4.8.2.3 Requirements for Products and Services – Review the Requirements for Products and Services
ISO 9001 Requirement	8.2.3 Review of the requirements for products and services
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.8.2.3.1 CQM Supplement

The Vendor shall establish, document and maintain procedures for order processing including responsibilities for accepting, checking and processing orders:

- Before acceptance and execution, the order shall be reviewed in order to ensure that the requirements are clearly defined, agreed and documented.
- Deviations between the tender, the contract and the order are resolved.
- The Vendor has the capability to fulfill all requirements resulting from the order.

Any deviation between the actual product or service intended to be delivered and the requirements resulting from the order shall be discussed and resolved with the customer prior to delivery.

4.8.2.4 #0664#: Requirements for Products and Services – Changes to Requirements for Products and Services

CQM Tag	#0664#
CQM Requirement	4.8.2.4 Requirements for Products and Services – Changes to Requirements for Products and Services
ISO 9001 Requirement	8.2.4 Changes to requirements for products and services
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.2.4.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.3 Design and Development of Products and Services

4.8.3.1 #0551#: Design and Development of Products and Services – General

CQM Tag	#0551#
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CQM Requirement	4.8.3.1 Design and Development of Products and Services – General
ISO 9001 Requirement	8.3.1 Design and development of products and services - General
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.3.2 #0552#: Design and Development – Design and Development Planning

CQM Tag	#0552#
CQM Requirement	4.8.3.2 Design and Development – Design and Development Planning
ISO 9001 Requirement	8.3.1 Design and Development Planning
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.8.3.2.1 CQM Supplement

The Vendor shall prepare a design plan for a design project when appropriate. With the aim to decrease time and cost related to approval procedures, the design plan shall anticipate the possible consequences of changes introduced either by Mastercard or by the Vendor. The design plan shall aim to optimize the reuse of previous design and developments outputs across these changes (e.g. by implementation of the modularity of the CQM Process).

A design plan shall contain:

- Objective and scope
- Input and requirements (legal, Vendor's and customer's requirements, CQM requirements, security aspects)
- Criteria for approval, documented in a Qualification Plan:
 - Product structure of the qualification approach, e.g. CQM Modular or not
 - Addressing the to be designed product and the related components, especially any CQM Components
 - Qualification approach related to each product requirement
 - Test methods to determine conformity with the criteria (samples size, pass/fail criteria)
 - Methods and criteria to approve software, if applicable
- Assessment procedures (to verify and validate design results)
- Resources (budget, required skills, qualified personnel, services of other departments, organizational interfaces, equipment)
- Responsibilities
- Timing (start and termination, timing of verification and validation)

- Documentation and records

A design plan shall include use of information from previous design reviews if those are relevant.

4.8.3.3 #0561#: Design and Development – Design and Development Inputs

CQM Tag	#0561#
CQM Requirement	4.8.3.3 Design and Development – Design and Development Inputs
ISO 9001 Requirement	8.3.3 Design and Development Inputs
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.3.3.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.3.4 Design and Development Controls

4.8.3.4.1 #0553#: Design and Development – Feasibility Study

CQM Tag	#0553#
CQM Requirement	4.8.3.4.1 Design and Development – Feasibility Study
ISO 9001 Requirement	8.3.4 Design and development controls
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.22.1	Editorial changes only: Moved to product specific QMS sections in cqmAP

A feasibility study including the review of all requirements for adequacy and non-ambiguity and the capability of the Vendor's organization with respect to the design project shall be conducted before the start of a major design project.

4.8.3.4.2 #0571#: Design and Development – Intermediate and Final Design Reviews

CQM Tag	#0571#
CQM Requirement	4.8.3.4.2 Design and Development – Intermediate and Final Design Reviews
ISO 9001 Requirement	8.3.4 Design and development controls
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing
Changelog:	

After V2.22.1	Editorial changes only: Moved to product specific QMS sections in cqmAP
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The Vendor shall review progress of a design project at appropriate stages and if necessary, shall adjust the design plan. Records of the reviews shall be maintained. All functions involved in the design process and in the further use of the product or service developed (e.g. production, marketing) shall participate in the review.

The Vendor shall review progress of a design project at appropriate stages defined in the design plan in order to ensure that the intermediate result at the stage of verification meets the requirements. Records about the assessment methodology used and results determined shall be generated and maintained.

The review result shall be used for improvement of the design process. The design review results shall be identified and communicated; the design plan shall be adjusted accordingly. Records about changes shall be maintained.

4.8.3.4.3 #0651#: Design and Development – Product Qualification Process

CQM Tag	#0651#
CQM Requirement	4.8.3.4.3 Design and Development – Product Qualification Process
ISO 9001 Requirement	8.3.4 Design and development controls
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.22.1	Editorial changes only: Moved to product specific QMS sections in cqmAP

The Vendor shall conduct Design and Development Validation in accordance with customer and Mastercard specified requirements including the applicable CQM requirements specified in this document.

The Vendor shall always qualify their products (per process) for volume production before the products are supplied as a CQM Product or a CQM Component.

For each applicable requirement specified in the Product Specification, the vendor shall determine that representative product samples ("Qualification Samples") conform to the requirement before the Product is produced in volume.

The Qualification of a CQM Product shall follow the Product Qualification Plan (see **#0582#: Design and Development – Product Qualification Plan**).

Qualification Samples shall be produced using the production process intended for volume production.

The vendor shall document the results of the Qualification of a Product in a Qualification Report.

The vendor may rely on qualification results that previously resulted from the qualification of other Products from the same Product Family where it is reasonable to assume that the new product performs at least equally well, due to the use of the same materials, components and processes.

For example, where a CB without any printing has shown to comply with the requirement for Opacity, there is no need to re-verify this for other CB products made from the same material (including material thicknesses) using the same processes but having different artwork. On the other hand, if it is only known that a CB with a certain artwork conforms to the Opacity requirement, it shall not be assumed that a CB with a different artwork conforms to the Opacity requirement too.

Evidence for compliance with this requirement typically includes:

- Documented and implemented procedure for the qualification and release of a product
- Documented and implemented procedure for the selection of equipment, methods and samples to be used for product qualification.
- Documented Product Qualification Plan in accordance with **#0582#: Design and Development – Product Qualification Plan**
- Documented Qualification Report in accordance with **#0654#: Design and Development – Product Qualification Report**



Note

Through considerate planning of the structure of Product Specifications, Product Families, and Qualification Plans the vendor can reduce the overall effort for the Qualification of Products.

4.8.3.4.4 #0582#: Design and Development – Product Qualification Plan

CQM Tag	#0582#
CQM Requirement	4.8.3.4.4 Design and Development – Product Qualification Plan
ISO 9001 Requirement	8.3.4 Design and development controls
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall develop, document, and maintain a qualification plan compliant with the terms of Mastercard's testing processes and CQM Requirements, comprising at least:

- Product requirements or reference to product requirements
- Qualification test methods and tools
- Production performance targets (capability of critical parameters, yields)
- Sample sizes and reject and acceptance criteria.

The Qualification Plan shall define how conformity with all requirements a Product shall comply with is verified.

The Qualification Plan shall at least address all of the applicable CQM Requirements, as defined in the applicable CQM Assessment Plan.

Sample sizes for testing conformity with CQM Requirements shall be at least the sample sizes defined for each applicable CQM Requirement in the CQM Assessment Plans. The Acceptance Number (see ISO 2859-1) shall always be 0 if the minimum sample sizes from the CQM Assessment Plans are used.

The vendor is permitted to use larger sample sizes for qualification tests than those specified in the CQM Assessment Plans. In this case the vendor may use 0 as the Acceptance Number, or determine the Acceptance Number from *ISO 2859-1, Single sampling plans for normal inspection*, in accordance with the following procedure:

- Determine the Equivalent AQL by finding the AQL with the number 0 under "Ac" (not an arrow pointing to the number 0) in the row with the sample size determined by the CQM Requirement, e.g. for the sample size 8 the corresponding AQL is 1.5 (and not 1.0 or 2.5, as those have arrows in that row). If no row corresponds to the sample size determined by the CQM Requirement, then the row corresponding to the next higher sample size shall be used.

Determine the applicable acceptance number from the Equivalent AQL and the intended sample size. If the intended sample size is not listed in this table in ISO 2859-1, then the next lower sample size in the table shall be used. E.g. if the Equivalent AQL is 1.5 and the intended sample size is 40, then the row is that corresponding to the next lower sample size 32 (because there is no row for sample size 40) and the Acceptance Number is hence 1.

4.8.3.4.5 #0654#: Design and Development – Product Qualification Report

CQM Tag	#0654#
CQM Requirement	4.8.3.4.5 Design and Development – Product Qualification Report
ISO 9001 Requirement	8.3.4 Design and development controls
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall document the results of a product qualification conducted in accordance with #0651#: Design and Development – Product Qualification Process in a Product Qualification Report.

The Product Qualification Report shall be documented, and the documented information shall include at least:

- Specification of the product qualified, e.g. by referencing the corresponding product specification created in accordance with **#0501#: Design and Development – Product Specification**,
- A reference to the utilized Product Qualification Plan (see **#0582#: Design and Development – Product Qualification Plan**),
- Equipment and processes used to produce the samples, e.g. by reference to a process specification,

- Samples used for product qualification; each sample should be individually identified, e.g. through sample identification numbers,
- For each requirement defined in the Product Qualification Plan (see [#0582#: Design and Development – Product Qualification Plan](#)), if the samples tested comply with the requirement,
- Documented evidence (control and measurement results) supporting the compliance of the samples with each requirement; and the documented evidence shall be traceable to individual samples, e.g. the sample identification numbers.

Samples used for product qualification should be retained until the product has been successfully introduced into volume production, or the product has been cancelled or discontinued, unless retaining such samples is not permitted by Mastercard mandated security requirements.

Lack of qualification results for conformity with applicable requirements shall be considered a critical NC and consequently prohibit CQM certification of the vendor for the related product. Furthermore, such missing qualification results are likely to restrict the related CSI letter to very small quantities.

Qualification results that indicate significant nonconformity with the CQM requirements and that are not covered by a CSI letter shall be considered a critical NC and consequently prohibit CQM certification of the vendor for the related product.

4.8.3.4.6 #0706#: Design and Development – Only Produce Qualified Products Using Qualified Processes

CQM Tag	#0706#
CQM Requirement	4.8.3.4.6 Design and Development – Only Produce Qualified Products Using Qualified Processes
ISO 9001 Requirement	8.1 Operational planning and control
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.22.1	Editorial changes only: Moved to product specific QMS sections in cqmAP

The Vendor shall establish and maintain a production planning system in order to ensure that:

- The product is covered by a valid CQM Certificate (status verification and product verification)
- Information defining the product ("Product Specification") is available
- Suitable manufacturing and test equipment is available
- Manufacturing and test instructions are available
- Appropriate monitoring and measurement techniques are available.

Production/work orders where the above conditions are not fulfilled shall not be executed.

4.8.3.5 #0581#: Design and Development – Design and Development Outputs

CQM Tag	#0581#
CQM Requirement	4.8.3.5 Design and Development – Design and Development Outputs
ISO 9001 Requirement	8.3.5 Design and Development Outputs
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.8.3.5.1 CQM Supplement

The outputs of design and development shall be in a form suitable for verification against the design and development input and shall be approved prior to release.

The output of the design and development process shall include:

- Product Specification in accordance with **#0501#: Design and Development – Product Specification**.
- Process Specification in accordance with **#0583#: Operational Planning and Control – Process Specification**
- Product Qualification Plan in accordance with **#0582#: Design and Development – Product Qualification Plan**
- Qualification Report
- Quality Control Plan in accordance with **#0701#: Production and Service Provision – Control of Production and Service Provision, QCP**

4.8.3.5.2 #0501#: Design and Development – Product Specification

CQM Tag	#0501#
CQM Requirement	4.8.3.5.2 Design and Development – Product Specification
ISO 9001 Requirement	
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall systematically document customer and CQM requirements.

The vendor shall specify Customer and CQM requirements for a specific product in a Product Specification and bring to attention to those who require this information (e.g. development, production, sales, etc.).

The Product Specification shall contain at least³:

- List of the main components and materials, including all included CQM Components
- Definition of the interfaces, as relevant
- Guidelines for personalization, as relevant

³ It is permissible that the Product Specification addresses the subsequent items through reference to other documents.

- Intended use and any related guidelines
- List of applicable requirements, including the applicable CQM requirements

The Product Specification often is, and in most cases is recommended to be modular and consists of different parts with different levels of variability.

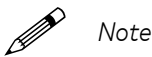
The Vendor may consider a group of products that share a significant part of their Product Specifications a Product Family (see **#0502#: Design and Development – Product Family**).

Where the specification of a product is based on a Product Family (see **#0502#: Product Family**), then the Product Specification shall include a reference to the Product Family Specification.

The vendor shall make the information contained in the Product Specification available to their relevant staff, such that the staff has knowledge of the relevant information to develop, design and produce the vendor’s products in a repeatable and well-defined manner, and to allow their staff to verify that the product produced complies with the applicable Product Specification.

4.8.3.5.3 #0502#: Design and Development – Product Family Specification

CQM Tag	#0502#
CQM Requirement	4.8.3.5.3 Design and Development – Product Family Specification
ISO 9001 Requirement	
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing



Note

The use of the concept of Product Family is optional, though vendors are likely to find that it often simplifies the tasks of specifying and qualifying products.

A Product Family is a group of Products that share a significant part of their Product Specification.

When the vendor declares that a group of products is a Product Family, according to **4.8.5.1.2 #0702#: Production and Service Provision – Product Family Based Sampling** , then the Vendor shall document the shared characteristics of the Product Family in a Product Family Specification.

The Product Family Specification shall follow in format and content the requirements for a Product Specification (see **#0501#: Design and Development – Product Specification**), containing the provisions from the product specification that the members of the Product Family share.

Where Product Family Specifications are used, the vendor should not replicate the shared provisions contained in the Product Family Specification, but simply refer to the Product Family Specification.

A typical example is a CB, where:

- the materials, processes and parameters remain unchanged for a range of Products, but
- the artwork is different for each Product,

and conclusively materials, processes and parameters are specified in a part of the Product Family Specification that remains unchanged over multiple orders, possibly over many years, while the artwork is specified order specific. Hence the Product Specification of a specific CB could consist of:

- a reference to the generic Product Family Specification (without the artwork), and
- an identification of the artwork.

Here also the qualification plan could be simplified in the case only the artwork changes, e.g. the Vendor verifies only:

- Thickness of the card, and
- Peel strength of the overlay,

And does not measure width and height of the card because they are not influenced by the details of the artwork.

Another example is the ICC, where:

- The CB with exception of the artwork remains unchanged for a range of products,
- And the ICM remains unchanged with the exception of the contained IC for a range of ICC,

and conclusively the Product Specification of a specific ICC could consist of:

- a reference to the CB family specification
- an identification of the artwork
- a reference to the ICM family specification
- an identification of the IC contained.

The vendor shall make the information contained in the Product Family Specification available to their relevant staff, such that the staff has knowledge of the relevant information to develop, design and produce the vendor's products in a repeatable and well-defined manner, and to allow their staff to verify that the product produced complies with the applicable Product Family Specification.

4.8.3.6 #0590#: Design and Development – Design and Development Changes

CQM Tag	#0590#
CQM Requirement	4.8.3.6 Design and Development – Design and Development Changes
ISO 9001 Requirement	8.3.6 Design and Development Changes
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement
Changelog:	
After V2.22	Editorial changes only

4.8.3.6.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.4 Control of externally provided Processes, Products and Services

4.8.4.1 #0601#: Control of externally provided processes, products and services - General

CQM Tag	#0601#
CQM Requirement	4.8.4.1 Control of externally provided processes, products and services - General
ISO 9001 Requirement	8.4.1 Control of externally provided processes, products and services - General
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement
Changelog:	
After V2.22	Editorial changes only

4.8.4.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.4.2 #0604#: Control of externally provided processes, products and services – Type and extent of control

CQM Tag	#0604#
CQM Requirement	4.8.4.2 Control of externally provided processes, products and services – Type and extent of control
ISO 9001 Requirement	8.4.2 Control of externally provided processes, products and services - Type and extent of control
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement
Changelog:	
After V2.22	Editorial changes only: Moved from QMS section in cqmAP to Product sections.

4.8.4.2.1 CQM Supplement

Externally provided materials, components and services shall be verified prior to use for the design and production of any product and service subject to CQM Certification using criteria defined by the Vendor. These criteria shall satisfy the Vendor's requirements, objectives and policies, and any applicable CQM requirements.

The Vendor shall establish and implement the inspection and other activities necessary for ensuring that purchased components and materials meet the specified purchase requirements.

Records about the verification of externally provided components and services shall be maintained.

All externally provided material, components and services (where appropriate) shall be traceable via an identification system.

Where an externally provided component is a CQM Component, the Vendor shall verify the component is covered by a valid CQM Label in accordance with **#0605#: Procured or subcontracted CQM Products and Components – CQM Certification Status**.

For components or materials that are not covered by a CQM Label, incoming inspection procedures, or a relevant quality assurance system through supplier inspections, shall be developed, documented, implemented and maintained in accordance with this requirement and cover at least:

- Parameters defining sample lot sizes and frequency of inspections,
- Acceptance criteria,
- The processing of non-conforming material.

Where the vendor subcontracts services that normally would be required to be included in the CQM Audit if the vendor were conducting these services themselves, then the vendor shall:

- Ensure and verify the services are conducted in accordance with the applicable CQM Requirements.
- Document and make available at the time of the audit evidence that these services are conducted in accordance with the applicable CQM Requirements. For testing services such evidence typically is either an ISO 17025 certificate including the relevant test method, or other documented evidence that the service provider conducts the services in accordance with the applicable CQM requirements.

4.8.4.2.2 #0605#: Procured or subcontracted CQM Products and Components – CQM Certification Status

CQM Tag	#0605#
CQM Requirement	4.8.4.2.2 Procured or subcontracted CQM Products and Components – CQM Certification Status
ISO 9001 Requirement	8.4.2 Control of externally provided processes, products and services - Type and extent of control
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

If a purchased or subcontracted component is a CQM Product or Component, the Vendor shall ensure that the purchased component is covered by either:

- a valid CQM Certificate; or
- the Vendor being in full control of qualification, process control, and quality control and quality monitoring of the CQM Product or Component, and that the CQM Product or Component conforms to the CQM Requirements, and that the underlying processes are in compliance with the CQM Requirements.

Personalizers shall only use CQM Products and CQM Components that are covered by a valid CQM Label.

4.8.4.3 #0603#: Control of externally provided processes, products and services - Information for external providers

CQM Tag	#0603#
CQM Requirement	4.8.4.3 Control of externally provided processes, products and services - Information for external providers
ISO 9001 Requirement	8.4.3 Control of externally provided processes, products and services - Information for external providers
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	Nothing

The Vendor shall specify clearly and sufficiently the material, component or service to be purchased, including, where appropriate:

- Characteristics
- Requirements for approval of components, procedures, processes and equipment,
- Requirements for qualification of personnel, and
- Quality management system requirements.

The Vendor shall ensure the adequacy of specified purchase requirements prior to communicating them to the supplier/Subcontractor.

4.8.4.4 #0606#: Subcontracted manufacturing of CQM Components – Introduction

Subcontracted manufacturing is when the entity:

- designing, specifying, and qualifying a CQM Component, and/or
- defining the Quality Control Plan specifying the quality control during production

is not producing the CQM Component themselves but utilizes manufacturing services from another entity (subsequently referred to as a Subcontractor).

Generally, the difference between a CQM Component Vendor and a Subcontractor is as follows:

The CQM Component Vendor:

- Designs, specifies, and qualifies the CQM Component
- Defines and implements their own Quality Control Plan
- owns the CQM Component they are producing and supplying

The Subcontractor:

- Receives a specification from their customer what and how to manufacture,
- Follows the Quality Control Plan provided by their customer at least in part,
- The Subcontractor does not own the CQM Component they are producing and supplying, they are producing their customer's CQM Component.

Note, that in case of doubt, it shall be assumed that the supplier of the CQM Component is a Subcontractor.

Examples for subcontracted manufacturing are:

- Example 1:
 - Company A designs a wire-embedded AIL, conducts the internal qualification and manages the external qualification of the AIL, and
 - Company A requests Company B to manufacture the inlay according to the specification provided by Company A; the specification defining the layout for the wire embedding, the diameter and type of wire, and the thickness and material of the plastic material the wire is embedded into.
- Example 2:
 - Company C designs an iacICM together with Company D. Company C owns the design of this specific iacICM, conducts the internal qualification, and sells the iacICM to other CQM Vendors, and
 - Company C requests Company D to manufacture the iacICM according to Company C's Quality Control Plan
- Example 3:
 - A wafer foundry produces wafers of an IC designed by their customer.

If a vendor subcontracts manufacturing instead of procuring a CQM Component Vendor's product, then the following requirements apply, depending on the CQM Certification Status of the Subcontractor:

Case 1 - The subcontractor is CQM Certified for the type of CQM Component:

- ***#0607#: Subcontracted manufacturing of CQM Components – CQM certified Subcontractors***

Case 2 – The subcontractor is not CQM certified for the type of CQM Component:

- ***#0608#: Subcontracted manufacturing of CQM Components – Subcontractors not CQM certified***

4.8.4.5 #0607#: Subcontracted manufacturing of CQM Components – CQM certified Subcontractors

CQM Tag	#0607#
CQM Requirement	4.8.4.5 Subcontracted manufacturing of CQM Components – CQM certified Subcontractors
ISO 9001 Requirement	8.5.1 Control of production and service provision
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): New

If a CQM Vendor subcontracts (see **#0606#: Subcontracted manufacturing of CQM Components – Introduction** for definition of subcontracting) production of a CQM Component to another company that maintains a CQM label for this type of CQM Component or CHD, then the CQM Vendor shall ensure, and demonstrate during their own CQM Assessment that the Subcontractor's subcontracted production of the CQM Component is done in compliance with the following requirements:

- The CQM Component is specified in accordance with **#0501#: Design and Development – Product Specification**, has been qualified in accordance with **#0582#: Design and Development – Product Qualification Plan**, and a qualification report in accordance with **#0654#: Design and Development – Product Qualification Report** is available;
- The process operated by the Subcontractor has been qualified in accordance with **#0653#: Operational Planning and Control – Process Qualification Report**
- A QCP is defined, agreed, and implemented in accordance with **#0701#: Production and Service Provision – Control of Production and Service Provision, QCP** and the QCP, as applied and implemented by the Subcontractor and the Vendor together, is compliant with the product requirements defined in the cqmAP for the specific CQM Component
- The production process conducted by the Subcontractor is specified and conducted in accordance with **#0583#: Operational Planning and Control – Process Specification**, and **#0584#: Operational Planning and Control – Process Control Plan**
- The Subcontractor operates, and retains adequate records, in compliance with **#0722#: Production and Service Provision – Product Traceability** and **#0723#: Production and Service Provision – Process Traceability**
- The use of CQM certifiable components and other components and materials complies with **#0605#: Procured or subcontracted CQM Products and Components – CQM Certification Status**, **#0741#: Production and Service Provision – Compliant Use of Materials and non-CQM Components**, and **#0742#: Production and Service Provision – Preservation of CQM Product and CQM Components during storage, processing and delivery**
- Either the Vendor, or the Subcontractor, or both in combination, control production output in compliance with **#0707#: Production and Service Provision – Batch Yield**

Limit and #0781#: Production and Service Provision – Control of Nonconforming Outputs

Verification of conformity with the above requirements does not require an on-site audit of the Subcontractor but may be conducted as a CQM Remote Assessment. The CQM Remote Assessment of such Subcontractor should not exceed 4 hours.



Note

The time interval of 4 hours allocated to the assessment of the CQM certified Subcontractor refers to the time allocated during the Vendor's CQM Audit and does not constitute a guideline nor a limitation for any audits the Vendor may decide to conduct on their suppliers and subcontractors.



Note

The manufacturing site where the subcontracted process steps are executed will be listed on the Vendor's CQM certificate for the respective activities.

4.8.4.6 #0608#: Subcontracted manufacturing of CQM Components – Subcontractors not CQM certified

CQM Tag	#0608#
CQM Requirement	4.8.4.6 Subcontracted manufacturing of CQM Components – Subcontractors not CQM certified
ISO 9001 Requirement	8.5.1 Control of production and service provision
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): New

If a CQM Vendor subcontracts (see **#0606#: Subcontracted manufacturing of CQM Components – Introduction** for definition of subcontracting) production of a CQM Component to another company that does not maintain a CQM label for this type of CQM Component or CHD, then the CQM Vendor shall ensure, and demonstrate during their own CQM Assessment that the Subcontractor's subcontracted production of the CQM Component is done in compliance with all CQM requirements applicable for this CQM Component or CHD.

Compliance with the applicable CQM requirements shall be ensured by the Vendor's and the Subcontractor's operations in combination. For example, where the Subcontractor's operation does not ensure compliance with a specific requirement, then the Vendor is still compliant if the Vendor ensures compliance with this requirement, for example:

- While the Subcontractor does not qualify the CQM Component or CHD, the Vendor qualifies it;
- While the Subcontractor does not conduct a required control as part of their process, the Vendor conducts this control on the CQM Component of CHD produced by the Subcontractor.

Assessment of the Subcontractor's operations shall be conducted in accordance with the rules applicable to CQM Audits of CQM Component Vendors. In specific cases the requirement for an on-site audit might be waived by CQM Operations upon request.

4.8.5 Production and Service Provision

4.8.5.1 #0701#: Production and Service Provision – Control of Production and Service Provision, QCP

CQM Tag	#0701#
CQM Requirement	4.8.5.1 Production and Service Provision – Control of Production and Service Provision, QCP
ISO 9001 Requirement	8.5.1 Control of production and service provision
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.8.5.1.1 CQM Supplement

When producing physical products, it cannot be reasonably assumed that every single item produced by volume production performs identically to the items used for Product Qualification. Therefore the vendor shall re-verify certain characteristics at defined intervals.

The Vendor shall develop, implement and maintain documented procedures to monitor and measure, on a regular basis, those key characteristics of its products and services that can have a significant impact on the fulfillment of all relevant requirements.

The vendor shall systematically document the quality control and monitoring measures in a Quality Control Plan, subsequently referred to as "QCP", defining at least the following information:

- Characteristic or Parameter controlled
- Means of control, e.g. procedure, measurement instrument
- Targets, specified tolerances etc.
- Frequency of testing and monitoring
- Responsibility

A QCP may consist of a single, or multiple documents, such as:

- Control Plan
- Quality Monitoring Plan
- Work Instructions
- Check Lists

Anyhow, it is recommended that the critical information about how compliance is ensured and monitored during volume production, is consolidated in a single document called Quality Control Plan, defining:

- Requirements for which conformity is monitored
- Means how conformity is monitored (e.g. test method, test tool, sampling frequency)
- Production step at which conformity is monitored
- Responsibility for monitoring conformity (e.g. Machine operator, QC engineer, external lab)
- Record form for the result (e.g. Lot traveller, Form XYZ)

The information contained in the QCP may be directly contained in the QCP (e.g. Sampling size) or by referencing another document (eg. a test procedure, a check list, or a reference to an item in the test equipment register defining a test tool) containing the information.

The QCP shall comply with the minimum requirements defined in the CQM Requirements and CQM Assessment Plans ("cqmAP").

By default, the vendor shall subject samples of every product produced to the required quality control and monitoring tests.

The vendor shall always test samples from every product produced for the following sampling rates defined in the cqmAP:

- 100%
- Number of samples per Batch
- Number of samples per Job
- Number of samples per Lot

For time based sampling rates defined in the cqmAP such as

- Samples per week
- Samples per year

the vendor may test samples from every product produced in the preceding interval, or use "Product Family based sampling" as defined in **4.8.5.1.2 #0702#: Production and Service Provision – Product Family Based Sampling**.

4.8.5.1.2 #0702#: Production and Service Provision – Product Family Based Sampling

CQM Tag	#0702#
CQM Requirement	4.8.5.1.2 Production and Service Provision – Product Family Based Sampling
ISO 9001 Requirement	8.5.1 Control of production and service provision
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

If the vendor complies with the following requirements:

- **#0501#: Design and Development – Product Specification**
- **#0583#: Operational Planning and Control – Process Specification**
- **#0582#: Design and Development – Product Qualification Plan**
- **#0651#: Design and Development – Product Qualification Process**
- **#0701#: Production and Service Provision – Control of Production and Service Provision, QCP**
- **#0721#: Production and Service Provision – Lot Based Production**
- **#0722#: Production and Service Provision – Product Traceability**

Then the vendor may introduce Product Family Based Sampling for qualification and monitoring.

If the vendor decides to use Product Family Based Sampling, the vendor shall do so in line with the following requirements:

For time-based sampling rates defined in the cqmAP the vendor may select samples representative for a product family to monitor the quality of the products contained in the product family.

Samples representative for a product family shall include the following:

- "High Runners", Products representing the main volume in a Product Family
- "Critical Products", Products that have shown more likely to be affected by reliability or durability issues during Qualification, Monitoring, or based on field reject information.

The Vendor shall determine High Runners and Critical Products based on verifiable information, such as Qualification Results, Monitoring Results, and information about problems in the field.

Characteristics that can cause Products being the "Critical Products" in a Product Family often include:

- IC with larger memory sizes have an increased die size (higher risk of mechanical failure, higher risk of memory failure)
- ICM containing large IC, long bonding wires, higher number of connections (higher risk of mechanical failure)
- ICC containing above ICM (higher risk of mechanical failure)
- CB with certain types of printing, or large coverage of specific inks or certain adhesives (higher risk of delamination)

The vendor shall specify the Product Family in a Product Family Specification according to:

- **4.8.3.5.3 #0502#: Design and Development – Product Family Specification**

Without Product Family based sampling the vendor is required to subject samples from every product produced during the preceding interval to the quality monitoring activity.

4.8.5.1.3 #0704#: Production and Service Provision – Product Reliability Monitoring

CQM Tag	#0704#
CQM Requirement	4.8.5.1.3 Production and Service Provision – Product Reliability Monitoring
ISO 9001 Requirement	8.5.1 Control of production and service provision
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall use a well-documented program of tests to monitor ongoing product performance. The program shall verify the capability of the product to meet the requirements of this document. The program shall use acceleration models and accelerated stress tests, where appropriate.

The Vendor shall determine typical use conditions for its products and shall use these conditions within the program.

The program shall identify the types of tests, the sample sizes per production period, and the acceleration models (when used).

Reliability monitoring data accumulated over the preceding six-month or twelve-month period shall be used to calculate failure rates.



Note

Evidence for compliance with this requirement typically includes documented and implemented processes to:

- *Assess the reliability of products related to the expected use-conditions.*
- *Apply in case the resulting reliability parameters are not met.*
- *Record methods involved in determination of use-conditions, resulting reliability parameters and statement of compliance.*



Note

Differences caused by the process can also occur, and shall be considered, such as those caused by differences in embossing equipment (different machine suppliers, different machine generations)

4.8.5.2 #0720#: Production and Service Provision – Identification and Traceability

CQM Tag	#0720#
CQM Requirement	4.8.5.2 Production and Service Provision – Identification and Traceability
ISO 9001 Requirement	8.5.2 Identification and traceability
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.5.2.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.5.2.2 #0721#: Production and Service Provision – Lot Based Production

CQM Tag	#0721#
CQM Requirement	4.8.5.2.2 Production and Service Provision – Lot Based Production
ISO 9001 Requirement	8.5.2 Identification and traceability
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall produce CQM Products in Lots.

Lots of all CQM Products with the exception of Personalization Lots shall be processed in Batches, thus produced using the same CQM Components, other components and materials, and Processes (including process parameters).

Lots of electronic components that become part of the finished CHD, such as IC, ICM, and IL shall be processed in Batches, thus produced using the same Components and Materials, Processes and Process Parameters.

Personalization Lots may be processed in Batches or Jobs, Jobs being a combination of different Batches of components to be processed using the same Processes and Process Parameters, but consisting of products that are different to some extent, in case of Personalization typically the artwork.



Note

Components and Materials may only be assumed to be "the same" if they are from the same Batch.

Any Vendor shall ensure traceability of Lots with respect to the utilized:

- Components in accordance with **#0722#: Production and Service Provision – Product Traceability**
- Processes and Process Parameters in accordance with **#0723#: Production and Service Provision – Process Traceability**

Vendors producing electronic components that become part of the finished CHD, such as IC, ICM, and IL vendors, shall ensure traceability of Lots with respect to the utilized:

- Components in accordance with **#0722#: Production and Service Provision – Product Traceability**
- Processes and Process Parameters in accordance with **#0723#: Production and Service Provision – Process Traceability**
- Materials

The Vendor shall be able to derive the lot information of a component or material from the lot information of the produced CQM Product.

The Vendor shall be able to retrieve process flows, process instructions and process parameters utilized to produce a specific product.



Note

See section 1.6 #A600# Definitions for definition of the terms Lot, Batch, Job.

4.8.5.2.3 #0722#: Production and Service Provision – Product Traceability

CQM Tag	#0722#
CQM Requirement	4.8.5.2.3 Production and Service Provision – Product Traceability
ISO 9001 Requirement	8.5.2 Identification and traceability
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

Any lot of CQM Components delivered to subsequent processes or supplied to customers shall at least be traceable regarding:

- Product (batch identifier, product type, Mastercard approval information).
- The production Site involved.

Product traceability may be established by applying an identifier to the product or the package containing a product or group of products (batch or lot) enabling assessment of above traceability data upon request.

4.8.5.2.4 #0723#: Production and Service Provision – Process Traceability

CQM Tag	#0723#
CQM Requirement	4.8.5.2.4 Production and Service Provision – Process Traceability
ISO 9001 Requirement	8.5.2 Identification and traceability
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall maintain process traceability.

The production process flow shall be well defined and documented; the applicable process parameters shall be well defined and documented.

The Vendor shall be able to retrieve process flows, process instructions and process parameters utilized to produce a specific product batch.

4.8.5.3 #0730#: Production and Service Provision – Property belonging to Customers or External Providers

CQM Tag	#0730#
CQM Requirement	4.8.5.3 Production and Service Provision – Property belonging to Customers or External Providers
ISO 9001 Requirement	8.5.3 Property belonging to customers or external providers
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.5.3.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.5.4 #0740#: Production and Service Provision – Preservation (of process Outputs)

CQM Tag	#0740#
CQM Requirement	4.8.5.4 Production and Service Provision – Preservation (of process Outputs)
ISO 9001 Requirement	8.5.4 Preservation
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.5.4.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.5.4.2 #0741#: Production and Service Provision – Compliant Use of Materials and non-CQM Components

CQM Tag	#0741#
CQM Requirement	4.8.5.4.2 Production and Service Provision – Compliant Use of Materials and non-CQM Components
ISO 9001 Requirement	8.5.4 Preservation
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The storage and processing of components and materials to produce CQM Products shall follow specifications and guidelines provided by the supplier.

Where the storage or processing of components is outside of the specifications and guidelines provided by the supplier, the Vendor shall verify the suitability of such storage or processing with the supplier prior to subjecting the component to such storage or processing.

4.8.5.4.3 #0742#: Production and Service Provision – Preservation of CQM Product and CQM Components during storage, processing and delivery

CQM Tag	#0742#
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CQM Requirement	4.8.5.4.3 Production and Service Provision – Preservation of CQM Product and CQM Components during storage, processing and delivery
ISO 9001 Requirement	8.5.4 Preservation
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall preserve the CQM Products and Components during storage, processing and delivery to the intended destination in order to maintain conformity to requirements. Preservation shall include identification, handling, processing, packaging, storage and protection.

The production and storage operations conducted by the Vendor shall not have any adverse impact on the conformity of CQM Components used to produce⁴ the Vendor's product.

4.8.5.5 #0750#: Production and Service Provision – Post-delivery Activities

CQM Tag	#0750#
CQM Requirement	4.8.5.5 Production and Service Provision – Post-delivery Activities
ISO 9001 Requirement	8.5.5 Post-delivery activities
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.5.5.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.8.5.6 #0761#: Production and Service Provision – Control of Changes

CQM Tag	#0761#
CQM Requirement	4.8.5.6 Production and Service Provision – Control of Changes
ISO 9001 Requirement	8.5.6 Control of Changes
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.8.5.6.1 CQM Supplement

The Vendor shall establish, document and maintain a Change Control and Change Management process.

The Vendor shall qualify changes to products to ensure that the resulting changed product is compliant with CQM Requirements.

⁴ For the avoidance of doubt, 'produce' includes 'personalize'

Qualification of changes to a Product shall follow a Product Qualification Plan, typically the Product Qualification Plan developed in accordance with **#0582#: Design and Development – Product Qualification Plan**.

The Vendor shall qualify changes to processes to ensure that the products produced with these processes remain compliant with CQM Requirements.

Qualification of changes to a Process shall follow a Process Qualification Plan, typically the Process Qualification Plan developed in accordance with **#0651#: Design and Development – Product Qualification Process**.



Note

It is recommended and the Vendor may find it useful to review the Qualification Plan in respect of the nature of the change and limit the qualification of changes to those criteria reasonably possibly affected by the change. The vendor may standardize the tests to be conducted following a specific change in a Change Control Matrix, or may define the applicable tests on a case-by-case basis following a risk assessment.

4.8.5.6.2 #0762#: Production and Service Provision – Change Notification Procedure

CQM Tag	#0762#
CQM Requirement	4.8.5.6.2 Production and Service Provision – Change Notification Procedure
ISO 9001 Requirement	8.5.6 Control of Changes
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	Nothing

The Vendor shall classify changes into minor and major changes as part of the change management process.

Major changes shall at least include:

- Change of the production Site
- Change of a CQM Component
- Process change that will be evident in the product, such as:
 - ICM: substrate, interconnection technology
 - CB or pICC: Plastic material
 - ICC: interconnection technology ICM/CB or ICM/Antenna
 - Perso: personalization technology
- Change of the CQM Primary Contact

The vendor may use a JEDEC compliant Product or Process Change Notice process, provided that changes to the CQM Primary Contact are also notified.

The Vendor shall inform Mastercard, or its designated third-party representative of major changes.

The notification shall at least include the following information:

- Identification of affected Mastercard Letter of Approval, if applicable and known to the vendor
- Identification of the affected CQM Label
- Description and reason of change
- Qualification plan and qualification report
- Projected dates for change implementation, for samples availability, for final internal qualification data
- Well defined procedure for internal qualification of change.

4.8.6 #0707#: Production and Service Provision – Batch Yield Limit

CQM Tag	#0707#
CQM Requirement	4.8.6 Production and Service Provision – Batch Yield Limit
ISO 9001 Requirement	8.6 Release of Products and Services
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.22	Editorial changes only: Split #0703# into #0703# and #0707#

4.8.6.1 CQM Supplement

4.8.6.1.1 For CQM Products containing IC, but excluding Personalization:

This requirement applies after electrical test of products containing an IC but is not applicable for Personalization.

The vendor shall conduct batch yield analysis ensuring only batches from within the normal yield distribution are supplied to subsequent process steps or customers without further investigation.

The vendor shall use a well-defined procedure to determine the statistically defined batch yield limits.

The investigation of lots with an electrical yield outside of the normal yield distribution shall ensure that the cause of the increased electrical failure rate will not affect functionality, usability, or reliability of products supplied to subsequent processes and into the field.

Where lot sizes are too small for reasonably applying yield limits to individual batches, data shall be collected over a range of batches of identical or very similar products⁵. This data collected over time shall be regularly and systematically analyzed to determine

⁵ 'very similar products' are products using the same IC and ICM, and the same embedding technology, but do not necessarily contain the same software or data.

systematic problems or weaknesses with specific products. In case such problems or weaknesses are determined, adequate actions shall be taken to reduce the occurrence of such problems or weaknesses.

4.8.6.1.2 For Personalization:

The vendor shall continuously monitor the electrical yield of personalization for the occurrence of unusually high electrical failure rates (e.g. "more than 5%"), or unusual clustering of electrical failures (e.g. "three in sequence").

The vendor shall define, document, and communicate to the relevant staff an internal rule clarifying when such occurrence of electrical failure rates shall be considered "unusually high", or when a clustering of electrical failures shall be considered "unusual".

When such unusual occurrence is detected, then the vendor shall perform an initial analysis to decide if the problem is caused by the equipment, or the cards, or materials used to personalize the cards.

If during the initial analysis the vendor determines the electrical failures are caused by:

- the equipment, then the vendor shall cease using the equipment causing the electrical failures until the cause is resolved.
- the cards, then the vendor shall cease processing the card batch⁶ that has shown the electrical failures, until the vendor has completed further analysis as required below.
- Some material used, then the vendor shall cease using the material.

When a vendor has determined that certain card batches cause an unusually high electrical failure rate or clustering of electrical failures during personalization, then the vendor shall:

- Systematically analyze the cause of this increased failure rate or failure clustering; and
- Take adequate action to ensure this cause will not affect the functionality, usability, or reliability of the product in the field; or if this cannot be ensured, that cards from these batches are not issued; and
- Document the findings and actions taken.

4.8.7 #0703#: Production and Service Provision – Release of Product and Services

⁶ Note the difference between batch and personlisation job. Within CQM, a batch of cards is a group of cards that have been produced homogenously, e.g. manufactured together using the same materials and parameters, and with ICM from the same ICM reel. A personalization job is a set of cards that are personalized together, but may have been taken from different batches of cards. Personalisation jobs consisting of cards from different batches but personalized together in one personlisation lot are sometimes referred to as 'rainbow lots' or 'rainbow batches' outside of CQM.

CQM Tag	#0703#
CQM Requirement	4.8.7 Production and Service Provision – Release of Product and Services
ISO 9001 Requirement	8.6 Release of Products and Services
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.22	Editorial changes only: Split into #0703# and #0707#



Note

CQM does not require the Vendor to specify a formal Release of Product process at the end of production. This section is solely kept as a placeholder.

4.8.8 Control of Nonconforming Outputs

4.8.8.1 #0781#: Production and Service Provision – Control of Nonconforming Outputs

CQM Tag	#0781#
CQM Requirement	4.8.8.1 Production and Service Provision – Control of Nonconforming Outputs
ISO 9001 Requirement	8.7 Control of Nonconforming Outputs
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.8.8.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.9 Performance evaluation

4.9.1 Monitoring, measurement, analysis and evaluation

4.9.1.1 #0810#: Performance evaluation – Monitoring, measurement, analysis and evaluation – General

CQM Tag	#0810#
CQM Requirement	4.9.1.1 Performance evaluation – Monitoring, measurement, analysis and evaluation – General
ISO 9001 Requirement	9.1.1 Monitoring, measurement, analysis and evaluation - General
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.9.1.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

4.9.1.1.2 #0705#: Performance evaluation – Statistical Process Control

CQM Tag	#0705#
CQM Requirement	4.9.1.1.2 Performance evaluation – Statistical Process Control
ISO 9001 Requirement	8.5.1 Control of production and service provision
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.22	Technical changes (incl. editorial changes): moved from QMS section in cqmAP to Product sections. No longer applicable for cb, icc, p.

Where applicable, the Vendor shall use Statistical Process Control techniques to keep the production process under control.

Critical process and product parameters for SPC control shall be defined.

This requirement is not applicable to products that do not involve the processing of wafers or the packaging of IC.

4.9.1.1.3 #0811#: Performance evaluation – Process Capability

CQM Tag	#0811#
CQM Requirement	4.9.1.1.3 Performance evaluation – Process Capability
ISO 9001 Requirement	9.1.1 Monitoring, measurement, analysis and evaluation - General
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

Where applicable, the Vendor shall determine the capabilities of the production processes.

Critical process parameters shall be well defined and CpK values shall be determined by product and by process.

CpK values shall be at least 1.0

This requirement is not applicable to products that do not involve the processing of wafers or the packaging of IC.



Note

For certain critical process parameters, the calculation of CpK is not useful or not the most appropriate solution. In such cases, other means of controlling the identified critical process parameters shall be defined and applied.

4.9.1.1.4 #0821#: Performance evaluation – Product Problem Analysis Infrastructure

CQM Tag	#0821#
CQM Requirement	4.9.1.1.4 Performance evaluation – Product Problem Analysis Infrastructure
ISO 9001 Requirement	9.1.1 Monitoring, measurement, analysis and evaluation - General

Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall be able to analyze and correct problems occurring in relation to each product covered by the CQM Label, both during production and in the field.

The Vendor shall be able to perform a failure analysis upon request, and is therefore required to maintain failure analysis and corrective action expertise and infrastructure.

When failure analysis results indicate a need for corrective action, the Vendor shall document a corrective action plan and schedule and track its completion

4.9.1.2 #0801#: Performance evaluation – Customer Satisfaction Assessment

CQM Tag	#0801#
CQM Requirement	4.9.1.2 Performance evaluation – Customer Satisfaction Assessment
ISO 9001 Requirement	9.1.2 Customer Satisfaction
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.9.1.2.1 CQM Supplement

The Vendor shall undertake formal customer satisfaction analysis at periodic intervals.

The results shall be communicated throughout the Vendor's organization to the parts the feedback is relevant for.

The results shall be the basis for improvement actions and subject to the management review.

4.9.1.3 #0831#: Performance evaluation – Analysis and Evaluation

CQM Tag	#0831#
CQM Requirement	4.9.1.3 Performance evaluation – Analysis and Evaluation
ISO 9001 Requirement	9.1.3 Analysis and evaluation
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.9.1.3.1 CQM Supplement

CQM considers conformity with the following requirements after personalization to be dependent primarily on the quality of the cards used for personalization, and not the personalization process, even though the potential problems with the card may only be revealed through the personalization process:

- **#3042#: Dynamic Bending Stress** ^[IS7810]

- **#4001#: Embossing – Card Dimensions after Embossing** ^[IS7810]
- **#4026#: Absence of Residual Stress**
- **#4027#: Overall Card Warpage of Personalized**

To reduce testing effort during monitoring, the vendor is permitted to select the samples from the relevant⁷ card constructions at the end of the card manufacturing process (lamination or ICM embedding respectively), subject the cards to a representative, worst-case personalization process, conduct the relevant monitoring tests, and assume the monitoring results to be representative for all the vendor's personalization sites.

For audit purposes, the vendor is always compliant with this supplement, as compliance with it is optional.

4.9.2 #0840#: Performance evaluation – Internal Audit

CQM Tag	#0840#
CQM Requirement	4.9.2 Performance evaluation – Internal Audit
ISO 9001 Requirement	9.2 Internal Audit
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.9.2.1 #0841#: Performance evaluation – Internal Assessment of Conformity to CQM requirements – CQM Assessment Plan and Internal Audit against CQM Requirements

CQM Tag	#0841#
CQM Requirement	4.9.2.1 Performance evaluation – Internal Assessment of Conformity to CQM requirements – CQM Assessment Plan and Internal Audit against CQM Requirements
ISO 9001 Requirement	9.2 Internal Audit
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing
Changelog:	
After V2.19.1	Editorial changes only: title amended to draw more attention to requirement to conduct internal audit against CQM Requirements

The Vendor shall establish, document and maintain a system of internal audit in order to verify whether its processes, and the products and services it provides within the CQM System comply with the CQM Requirements.

The Vendor shall periodically, at least annually, conduct internal assessments to determine the level of compliance of the Vendor's operations to CQM Quality Management System Requirements and of the Vendor's products to CQM Product Requirements and document the results in the CQM Assessment Plan Form.

⁷ A card construction shall be considered relevant for monitoring, when it produced in significant volume, and is not intended to become obsolete or end-of-life within the next 24 months.

The vendor shall conduct at least one internal assessment for conformity to CQM Requirements in the 6-month period preceding a CQM Audit.

Assessment of the CQM Assessment Plan Form completed by the Vendor is a mandatory part of the CQM Audit.



Note

ISO19011 provides guidelines for quality and/or environmental management systems auditing.

4.9.3 Management Review



Note

CQM does not require a separate CQM Management Review in addition to the ones conducted already, e.g. in addition to those conducted to fulfil the related ISO 9001 requirements. What the CQM specific requirements below do require is that the items below are addressed during a management review, e.g. can be identified on the agenda and in the report or other output of the management review.

4.9.3.1 #0861#: Performance evaluation – Management Review - General

CQM Tag	#0861#
CQM Requirement	4.9.3.1 Performance evaluation – Management Review - General
ISO 9001 Requirement	9.3.1 Management Review
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.9.3.1.1 CQM Supplement

Management Reviews shall be conducted at least annually.



Note

This is not a requirement for an additional "CQM Management Review", if the Vendor already conducts Management Reviews, e.g. those required by ISO 9001. The purpose of this requirement is to require companies who have not yet introduced formal management reviews (usually companies not ISO 9001 certified) to do so.

4.9.3.2 #0862#: Performance evaluation – Management Review Inputs

CQM Tag	#0862#
CQM Requirement	4.9.3.2 Performance evaluation – Management Review Inputs
ISO 9001 Requirement	9.3.2 Management review inputs
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.9.3.2.1 CQM Supplement

The input to the management review shall include:

- Internal CQM audit records
- External CQM audit records
- Other conformity assessment results related to CQM requirements

4.9.3.3 #0863#: Performance evaluation – Management Review Outputs

CQM Tag	#0863#
CQM Requirement	4.9.3.3 Performance evaluation – Management Review Outputs
ISO 9001 Requirement	9.3.3 Management review outputs
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.9.3.3.1 CQM Supplement

The output from the management review shall include decisions and actions relating to:

- Conformity with CQM Requirements.

4.10 Improvement

4.10.1 #0880#: Improvement – General

CQM Tag	#0880#
CQM Requirement	4.10.1 Improvement – General
ISO 9001 Requirement	10.1 Improvement - General
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.10.1.1 #0883#: Improvement – Customer Complaints, and other Customer Feedback

CQM Tag	#0883#
CQM Requirement	4.10.1.1 Improvement – Customer Complaints, and other Customer Feedback
ISO 9001 Requirement	10.2 Improvement - Nonconformity and Corrective Action
Applicable	CQM Requirement
ISO 9001 Cert covers	Nothing

The Vendor shall systematically analyze customer feedback, including Customer Complaints, to determine opportunities for improvement.

The use of a formalized methodology to process complaints, such as the 8D problem solving methodology, is highly recommended.

The Vendor shall define Improvement Actions to remedy deficiencies in Products and Services that gave rise to Customer Complaints.

The vendor shall manage these Improvement Actions in a systematic way in conformity with #0882# to ensure the risks that gave rise to Customer Complaints are mitigated in future.

4.10.2 #0882#: Improvement – Nonconformity and Corrective Action

CQM Tag	#0882#
CQM Requirement	4.10.2 Improvement – Nonconformity and Corrective Action
ISO 9001 Requirement	10.2 Improvement - Nonconformity and Corrective Action
Applicable	ISO Requirement & CQM Supplement
ISO 9001 Cert covers	ISO Requirement

4.10.2.1 CQM Supplement

The Vendor shall raise and manage Improvement Actions systematically, including those resulting from:

- Customer Complaints
- Internal Audits
- External Audits
- Internally raised Corrective and Preventive Action requests

Raising and managing Improvement Actions systematically shall encompass:

- Defining and maintaining a documented process to raise and administer Improvement Actions, including corrective and preventive actions;
- Maintaining a register of Improvement Actions, defining for each corrective action:
 - a reference to the item that gave rise to the Improvement Action, such as a customer complaint, an internal or external audit report, or a Corrective and Preventive Action Request;
 - responsibility and target date;
- Monitoring progress of completing the Improvement Action
- Informing and periodically reminding responsible personnel of their assigned Improvement Actions, including but not limited to the time an Improvement Action becomes due, or while it is overdue;
- Periodically reviewing the register of Improvement Actions, eg to re-assign overdue ones to other personnel, or cancelling an overdue action if the organisation is not able to execute the Improvement Action with a justifiable effort.

The Vendor shall maintain records of completed and cancelled Improvement Actions.

A priority and impact-based management of Corrective Actions is highly recommended.

4.10.3Improvement – Continual Improvement

4.10.3.1 #0881#: Improvement – Continual Improvement

CQM Tag	#0881#
CQM Requirement	4.10.3.1 Improvement – Continual Improvement
ISO 9001 Requirement	10.3 Improvement - Continual Improvement
Applicable	ISO Requirement
ISO 9001 Cert covers	ISO Requirement

4.10.3.1.1 CQM Supplement

CQM defines no supplementary provisions for this requirement. Compliance with the corresponding ISO 9001 requirement suffices.

Part C

Product Requirements and Test Methods for the IC Vendor

PART C CONTAINS THE FOLLOWING CHAPTERS:

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5 IC Requirements - Requirements applicable to the component IC

This chapter defines the Product Requirements applicable to the Component IC.

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5.1.1	#2001#: IC Dimensions – maximum area and width to height ratio	128
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5.1 General – applicable to IC independent of the interface ("IC")

5.1.1 #2001#: IC Dimensions – maximum area and width to height ratio

CQM Tag	#2001#		
CQM Requirement	5.1.1 #2001#: IC Dimensions – maximum area and width to height ratio		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Activity		
Test Method	#6001#		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The lateral dimensions of the IC are called X and Y subsequently.

The area $X \times Y$ of the IC shall not exceed 20 mm².

The ratio between larger and smaller dimensions x and y shall not exceed: $0.5 < x/y < 2.0$.

The IC thickness after processing of the back shall not exceed 200 µm when produced for assembly in contact or dual interface modules using wire-bonding technology.

The IC thickness after processing of the back shall not exceed 180 µm when produced for assembly in contactless-only modules using wire-bonding technology.

Larger IC are permitted if the IC vendor can demonstrate that compensating measures have been taken, such as further thinning of the IC or special packaging of the IC, to ensure cards produced with such larger IC survive all the mechanical and environmental stress test defined for cards and other form factors in this document.

Test Method: **#6001#: IC Dimensions**

5.1.2 #2002#: Passivation Layer Integrity

CQM Tag	#2002#		
CQM Requirement	5.1.2 #2002#: Passivation Layer Integrity		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Activity		
Test Method	#6002#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 5		
CQM Monitoring	None required		

IC Requirements - Requirements applicable to the component IC

General – applicable to IC independent of the interface (“IC”)

The passivation layer shall not reveal any lack of integrity as a result of the Integrity Test (see section **#6002#: Passivation Layer Integrity**).



Note

The sampling rate applies to IC. If the vendor inspects a number of 'locations' on the wafer and each location encompasses multiple dies, then the vendor inspects at least twice the number of dies than locations.

5.1.3 #2003#: IC Backside Roughness

CQM Tag	#2003#		
CQM Requirement	5.1.3 #2003#: IC Backside Roughness		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Activity - Any IACICM Activity - any Biometric Sensor Module - iacIL with at least one unpackaged IC - IAC produced using bare dice		
Test Method	#6003#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Set-up.		

The back of the IC shall comply with:

- $r_n < 0.5 \mu\text{m}$ (r_n is the average roughness)
- $r_t < 5 \mu\text{m}$. (r_t is the total roughness, i.e. the peak roughness r_p plus the valley roughness r_v .)



Note

Processing of the back (e.g. wafer thinning) can leave high residual stress on the wafer. This shall be avoided as it generally lowers the mechanical reliability of the IC and thus the card.



Note

r_t should be less than $2 \mu\text{m}$. This limit may become mandatory in a future release of this document. cmP⁸ processing, which is customary in a back lapping final operation, shall give an r_t parameter of less than $1 \mu\text{m}$.



Note

If the IC Provider can demonstrate that process control mechanisms are in place that ensure a control of the backside roughness at least as good as required here, then such controls are permitted instead of measuring the roughness.

Test Method: **#6003#: IC Backside Roughness**

⁸ cmP: Chemical Mechanical Planarization

5.1.4 #2004#: IC Visual Aspect – absence of critical defects

CQM Tag	#2004#		
CQM Requirement	5.1.4 #2004#: IC Visual Aspect – absence of critical defects		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<ul style="list-style-type: none">- Grinding and polishing IC Wafer- Applying a Redistribution Layer to the Wafer- Applying Bumps to the Wafer- Sawing the IC Wafer- Any IACICM Activity- any Biometric Sensor Module- iacIL with at least one unpackaged IC- IAC produced using bare dice		
Test Method	#6004#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	5 items every Batch.		

The IC shall be free of critical defects on the IC's active surface, on the backside, and along the scribe lines.

MIL STD 883, in method 2010, defines the critical defects on the IC surface (e.g. excluding scribe line area).

Critical defects on the scribe line area (along IC periphery) are cracks or 'chip outs' that extend into active circuit areas.

IC and wafer shall be free of critical defects on the back, including:

- Cracks on the surface (any length)
- Cracks starting from the scribe line (any length)
- Examples of Wafer and Die Anomalies defined in Annex B of JEDEC JESD22-B118

The wafer support shall be free of silicon particles, e.g. like those originating from the wafer because of insufficient cleaning during and after sawing.



Note

IC identified as rejects, e.g. through inking or wafer mapping are not required to be free of the type of defects defined in this requirement.

Test Method: **#6004#: IC Visual Aspects**

5.1.5 #2005#: Mechanical Robustness – Flex Stress Robustness

CQM Tag	#2005#
CQM Requirement	5.1.5 #2005#: Mechanical Robustness – Flex Stress Robustness

IC Requirements - Requirements applicable to the component IC

General – applicable to IC independent of the interface (“IC”)

Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Grinding and polishing IC Wafer - Any IACICM Activity - any Biometric Sensor Module - iacIL with at least one unpackaged IC - IAC produced using bare dice		
Test Method	#6006#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		
Changelog:			
After V2.22.1	Technical changes (incl. editorial changes): made specifically applicable to wafer backside processing		

If the die size is too small to conduct the test, a test sample from the wafer larger than a single die and with an appropriate size for the test (typically at least 3 mm²) shall be used instead. In such case the center point for the test shall be on the active area of an IC and not in a sawing gap.

The die shall not crack after being exposed to #6006#: Die Flex Stress Test with a pressure of 250 MPa.

Test Method: **#6006#: Die Flex Stress Test**

5.1.6 #2006#: X-rays [IS7810]

CQM Tag	#2006#		
CQM Requirement	5.1.6 #2006#: X-rays [IS7810]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Activity		
Test Method	#6008#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Editorial changes only: clarified that any IC inside the CHD must comply with this requirement.		

Any IC contained in the CHD shall comply with the requirement *ISO/IEC 7810 X-Rays*.

Furthermore, for programmable/erasable non-volatile memories:

- Data recorded previous to X-ray exposure shall not be modified
- Programming and erasing of data shall be possible with same restrictions and permissions as prior to exposure.

IC Requirements - Requirements applicable to the component IC

General – applicable to IC independent of the interface (“IC”)



Note

The CHD could be exposed to an X-ray or e-beam dose much greater than that specified in ISO/IEC 7810 in some countries, e.g. in mailing systems. Such radiation doses can cause malfunction and can induce reliability failures.



Note

Testing in ICM or Card format is permitted.

Test Method: **#6008#: X-Rays [IS10373-1]**

5.1.7 #2007#: Static Magnetic Fields [IS7810]

CQM Tag	#2007#		
CQM Requirement	5.1.7 #2007#: Static Magnetic Fields [IS7810]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Activity		
Test Method	None defined		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

After exposure to a static magnetic field of 636000 A/m (8000 Oerstedt), the IC shall operate correctly. Furthermore, particularly in the case of programmable/erasable nonvolatile memory:

- Data recorded previous to field exposure shall not be modified
- Programming and erasing of data shall be possible after exposure



Note

The data content of a magnetic stripe might be erased by such a field.



Note

The IC shall not be electrically connected to a reader when exposed to an electromagnetic field above 1000 Oerstedt.



Note

With current IC technologies it may be assumed that the Requirement is fulfilled. Therefore, no test-method is defined in this document and no testing for conformity is required.



Note

Testing in ICM or Card format is permitted.

5.2 Contact – applicable to IC having a contact interface IC ("KIC")

5.2.1 #2008#: ESD Robustness to HBM at Contact Pads

CQM Tag	#2008#		
CQM Requirement	5.2.1 #2008#: ESD Robustness to HBM at Contact Pads		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	#6009#		

IC Requirements - Requirements applicable to the component IC

Contact – applicable to IC having a contact interface IC (“KIC”)

Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 3
CQM Monitoring	None required

The IC shall operate correctly after exposing any of the contact pins to electrostatic discharges up to 4 kV (ESD model: 'human body' model).

Particularly regarding programmable/erasable non-volatile memories:

- Data recorded prior to ESD exposure shall not be modified
- Programming and erasing of data shall be possible with same restrictions and permissions as prior to exposure.

Product family-based sampling is recommended.



Note

While the requirement does not explicitly specify that the device must pass the test at both polarities, this is defined in the referenced test method.

Test Method: **#6009#: Electrostatic Discharges (ESD)** [IS10373-1]

5.2.2 #2009#: Latch-up

CQM Tag	#2009#		
CQM Requirement	5.2.2 #2009#: Latch-up		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	#6012#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 3		
CQM Monitoring	None required		

The Latch-up Phenomenon shall not damage the IC. It can be assumed that there is no damage if the IC operates correctly after exposure to latch-up tests (over voltage and over current, positive and negative).

Applying, to any of the ICC's contacts, a voltage between – 0.3 V and Vcc Maximum +0.3 V for a prolonged amount of time shall not damage the IC (with the GND contact remaining at 0 V and where Vcc Maximum is the Maximum supply voltage as defined for the voltage class in [EMVK]).

IC Requirements - Requirements applicable to the component IC

Contact – applicable to IC having a contact interface IC (“KIC”)



Note

Latch-up is a state in which a low-impedance path resulting from an over-stress that triggers a parasitic thyristor structure persists after removal or cessation of the triggering condition.



Note

This requirement intends to ensure protection of the IC against abnormal contact scenarios as may be caused by readers in the field that operate outside of [EMV], such as may be caused by poor maintenance, aging of components, or production variations.

Test Method: **#6012#: Latch-up**

5.2.3 #2010#: Max Input Voltage Ratings - Contact Pads

CQM Tag	#2010#		
CQM Requirement	5.2.3 #2010#: Max Input Voltage Ratings - Contact Pads		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	#6013#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		

The IC shall continue operating normally after applying 6.5 V to any of its contact pads, with the GND pad connected to 0V. (Antenna pads floating).

Test Method: **#6013#: Max Input Voltage Ratings - Contact Pads**

5.2.4 #2011#: Product Reliability

CQM Tag	#2011#		
CQM Requirement	5.2.4 #2011#: Product Reliability		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Activity		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

The IC shall be reliable and secure. In order to guarantee the expected life time of three years for the card, the Vendor shall develop and apply a reliability model including at least the following factors:

- The temperature gradient
- On cycle
- Off cycle

IC Requirements - Requirements applicable to the component IC

Contact – applicable to IC having a contact interface IC ("KIC")

- Power-on time of 500h at 25 °C

Regarding this model, the IC failure rates and performance shall be:

- 'failure rate': below 50 FIT⁹ (at 25 °C; 60 % confidence level; with 0.5 eV activation energy for failures)
- 'data retention' performance: at least equivalent to 10 years at 25 °C (calculated from data using a confidence level of 60 %, and an activation energy of 0.6 eV for data retention failures)
- 'program/erase cycling' performance: at least 100.000 cycles (calculated from test at 25 °C, at nominal V_{CC} with global or block mode programming during cycling, confidence level 60%)

5.2.5 #2012#: VPP Contact ("VPP")

CQM Tag	#2012#		
CQM Requirement	5.2.5 #2012#: VPP Contact ("VPP")		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The IC shall not require V_{PP}.



Note

V_{PP} is the external voltage sometimes required by an IC to program the IC's non-volatile Memory (e.g. the E²PROM). Current IC technology creates V_{pp} internally and does not require an external connection.

5.2.6 #2013#: Supply Voltage (VCC)

CQM Tag	#2013#		
CQM Requirement	5.2.6 #2013#: Supply Voltage (VCC)		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	#6018#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		

⁹ FIT: 'Failure in Time', 1 FIT = 1 failure per 10⁹ device hours. A failure rate of 50 FIT is app. 1/100000 per year

IC Requirements - Requirements applicable to the component IC
Contact – applicable to IC having a contact interface IC ("KIC")

CQM Monitoring	100% control required
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The IC shall support the voltage classes defined in, and as defined in [EMVL] 5.1 and 5.3.6.

The IC shall operate correctly with a supply voltage V_{CC} within the operating voltage range as defined for its classes (AB or ABC) and within a temperature range from 0 °C to 70 °C and at any frequency within the specified clock frequency range.

For testing conformity with this requirement during monitoring, testing the IC at minimum and maximum V_{CC} , and the minimum and maximum clock frequency defined in [EMVL], and at room temperature shall be deemed compliant.

5.2.7 #2014#: Supply Current (ICC)

CQM Tag	#2014#		
CQM Requirement	5.2.7 #2014#: Supply Current (ICC)		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	100% control required		

The maximum peak supply current drawn by the ICC through the VCC contact shall not exceed the limits defined in [EMVK] 5.1 and 5.3.6.

When V_{CC} is stable and within the specified operating range, and over the temperature range 0 °C to 70 °C, and the voltages at the other contacts are between -0.3V and $V_{CC} + 0.3$ V, the maximum peak supply current drawn from V_{CC} or delivered via GND shall never exceed 50 mA for class A and B cards and 30 mA for class C, and remain in compliance with [EMV1] 5.1 and 5.3.6.

For testing conformity with this requirement during monitoring, testing the IC at minimum and maximum V_{CC} , and the minimum and maximum clock frequency defined in [EMVK], and at room temperature shall be deemed compliant.

5.2.8 #2015#: CLK Contact ("CLK") [[EMVK] – § 5.3.4]

CQM Tag	#2015#		
CQM Requirement	5.2.8 #2015#: CLK Contact ("CLK") [[EMVK] – § 5.3.4]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	#6019#		
Default CQM Q-Plan:			

IC Requirements - Requirements applicable to the component IC
Contact – applicable to IC having a contact interface IC ("KIC")

CQM Qualification	Minimum Sample Size: 70
CQM Monitoring	100% control required

The IC shall operate correctly with every CLK signal compliant with [EMVK], § 5.3.4 being connected to the CLK Contact.



Note

The note "The ICC shall not be damaged ..." in Table 5 in [EMVK], § 5.3.4 shall be interpreted as the maximum voltage being applied to the CLK contact being $V_{CC} + 0.3$ V and the minimum voltage being applied to the CLK voltage -0.3 V. There is no time limitation for the voltage being in the range between the nominal values in the table and the extended values in the note.

In addition, whatever the class of the IC, the current flowing through the CLK-contact (I_{CLK}) of the IC shall be between $-100 \mu A$ and $+100 \mu A$ depending on the IC design.

For testing conformity with this requirement during monitoring, testing the IC at minimum and maximum V_{CC} , and the minimum and maximum clock frequency defined in [EMVK], and at room temperature shall be deemed compliant.

5.2.9 #2016#: I/O Contact ("I/O") [EMVK] §5.3.2]

CQM Tag	#2016#		
CQM Requirement	5.2.9 #2016#: I/O Contact ("I/O") [EMVK] §5.3.2]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	#6020#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	100% control required		

The I/O contact has two modes, of which the reception mode is the default mode. The IC shall only switch to Transmission Mode to transmit data.

In the absence of the clock signal, or when in transmission mode, the IC shall continue its operation un-influenced by the voltage level on the I/O contact or the current flowing through it.

The IC shall be able to withstand intermittent short-circuit conditions between I/O and V_{CC} , or GND, of any duration and at all times during its operation without incurring any damage or degradation to its performance.

5.2.9.1 Reception Mode

When in reception mode, the IC shall observe the voltage level on the I/O contact and shall operate correctly with every [EMVK], § 5.3.2.1 compliant I/O signal connected to the I/O contact.



Note

The note "The ICC shall not be damaged ..." in Table 3 given in [EMVK], § 5.3.2.1 shall be interpreted as the maximum voltage being applied to the I/O contact being $V_{CC} + 0.3\text{ V}$ and the minimum voltage applied to the I/O being -0.3 V . There is no time limitation for the voltage being in the range between the nominal values in the table and the extended values in the note.

In addition, the current flowing through the I/O-contact ($I_{I/O}$) of the IC shall be between $-1000\text{ }\mu\text{A}$ and $+20\text{ }\mu\text{A}$ for voltages between -0.3 V and $V_{CC} + 0.3\text{ V}$.

For testing conformity with this requirement during monitoring, testing the IC at minimum and maximum V_{CC} , and the minimum and maximum clock frequency defined in [EMVK], and at room temperature shall be deemed compliant.

5.2.9.2 Transmission Mode

The IC shall generate an [EMVK], § 5.3.2.2 compliant I/O signal while connected to an [EMVK] § 5.5.2.2. compliant terminal I/O contact.

The IC shall not incur any damage if the terminal's I/O contact and the IC's I/O contact are both in transmission mode.

For testing conformity with this requirement during monitoring, testing the IC at minimum and maximum V_{CC} , and the minimum and maximum clock frequency defined in [EMVK], and at room temperature shall be deemed compliant.

5.2.10#2017#: RST-Contact ("RST") [EMVK] § 5.3.5]

CQM Tag	#2017#		
CQM Requirement	5.2.10 #2017#: RST-Contact ("RST") [EMVK] § 5.3.5]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface		
Test Method	#6021#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	100% control required		

IC Requirements - Requirements applicable to the component IC

Contact – applicable to IC having a contact interface IC ("KIC")

The IC shall operate correctly with every [EMVK], § 5.3.5 compliant RST signal connected to the RST Contact.



Note

The note "The ICC shall not be damaged ..." in Table 6 given in [EMVK], § 5.3.5 shall be interpreted as the maximum voltage being applied to RST being $V_{CC} + 0.3$ V and the minimum voltage applied to RST being -0.3 V. There is no time limitation for the voltage being in the range between the nominal values in the table and the extended values in the note.

In addition, the current flowing through the RST-contact (I_{RST}) of the IC shall be between -50 μ A and 50 μ A.

For testing conformity with this requirement during monitoring, testing the IC at minimum and maximum V_{CC} , and the minimum and maximum clock frequency defined in [EMVK], and at room temperature shall be deemed compliant.

5.2.11 #2018#: Answer-to-Reset ("ATR")

CQM Tag	#2018#		
CQM Requirement	5.2.11 #2018#: Answer-to-Reset ("ATR")		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contact Interface - ICM with a Contact Interface - Inlay with 7816-2 contacts - IC Card having a Contact Interface - IACICM with a Contact Interface - Inlay with 7816-2 contacts - IAC having a Contact Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	100% control required		

The IC shall successfully pass through the ATR sequence as specified in the applicable parts and versions of ISO/IEC 7816 and [EMVK].

The IC shall provide a response as specified for the IC in its current software configuration:

- Loaded (Flash) and/or hard-coded (ROM) OS and application(s)
- Pre-personalization status
- Personalization status

The correct ATR shall be verified before the IC, and any component or product containing it is shipped or forwarded to be incorporated into another CQM component or CQM Product, or to an issuer or cardholder.

If the device does not provide an ATR due to its programming or loading status, e.g. if the device's non-volatile program memory has not been loaded yet and only a bootstrap loader is active within the device, then verification of a well defined and documented response relevant to the IC's current status shall be considered as compliant with this requirement.

If the correct ATR is verified immediately after the loading of flash memory, and within the flash loading apparatus, then this shall be considered a check compliant with this requirement. Conformity with this requirement does not require an ATR testing operation in a device physically distinct from the loading device.

IC Requirements - Requirements applicable to the component IC
Contactless – applicable to IC having a contactless interface ("PIC")

5.3 Contactless – applicable to IC having a contactless interface ("PIC")

5.3.1 #2019#: ESD Robustness to HBM at Antenna Pads

CQM Tag	#2019#		
CQM Requirement	5.3.1 #2019#: ESD Robustness to HBM at Antenna Pads		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6010#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 3		
CQM Monitoring	None required		

The IC shall continue to function normally after exposure of any of the antenna pads to electrostatic discharges up to 3 kV (ESD model: 'human body' model). Particularly regarding programmable/erasable nonvolatile memories:

- Data recorded previous to ESD exposure shall not be modified
- Programming and erasing of data shall be possible with same restrictions and permissions as prior to exposure.
- Product Family based sampling is recommended for verifying conformity to this requirement.

Test Method: **#6010#: ESD Robustness to HBM at Antenna Pads**

5.3.2 #2020#: ESD Robustness to CDM at Contact Pads – IC connected to antenna in ICC

CQM Tag	#2020#		
CQM Requirement	5.3.2 #2020#: ESD Robustness to CDM at Contact Pads – IC connected to antenna in ICC		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6016#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 3		
CQM Monitoring	None required		

This requirement is only applicable to IC being connected to both an antenna and ISO/IEC 7816-2 based contacts.

The IC shall continue to function normally after being charged to a high voltage using a high voltage source or an electromagnetic field and then this charge discharged into ground through a resistance of less than 1 Ω with a current of at least 10 A through any of the exposed contacts.

Particularly regarding programmable/erasable nonvolatile memories:

- Data recorded previous to ESD exposure shall not be modified
- Programming and erasing of data shall be possible with same restrictions and permissions as prior to exposure.

Product Family based sampling is recommended for checking conformity to this requirement.

5.3.3 #2021#: Max Input Voltage Ratings - Contactless Pads

CQM Tag	#2021#		
CQM Requirement	5.3.3 #2021#: Max Input Voltage Ratings - Contactless Pads		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 3		
CQM Monitoring	3 items every Year.		

The IC shall continue to function normally after applying an alternating differential input signal with an amplitude of $V_{pp,max}$ between both antenna connection pads for 30 sec, without any effective current limitation, and a frequency of 13.56 MHz.

The IC Vendor shall define $V_{pp,max}$ to be at least the maximum voltage occurring at the antenna connection pads when the IC connected to either reference antenna is tested for conformity to **5.3.4 #2022#: Alternating Magnetic Fields**. The IC Card contact pads should be floating when testing for conformity with this requirement.



Note

V_{pp} in the above sentence refers to “Voltage-Peak-to-Peak”, not to “Programming Voltage Contact”

For monitoring the vendor shall use adequate parameters to ensure the IC will survive the 30 second exposure defined above, but the vendor is not required to test that condition for a period of 30 s during monitoring. It is up to the vendor to determine test parameters for monitoring including the exposure time so the vendor can ensure the IC fulfils this requirement.

5.3.4 #2022#: Alternating Magnetic Fields

CQM Tag	#2022#		
CQM Requirement	5.3.4 #2022#: Alternating Magnetic Fields		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production

IC Requirements - Requirements applicable to the component IC

Contactless – applicable to IC having a contactless interface (“PIC”)

Applicable to CQM Products	- IC with a Contactless Interface
Test Method	#6015#
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 3
CQM Monitoring	None required

The IC – connected to any reference antenna specified by the IC Vendor – shall comply with the requirement ISO/IEC 14443-1 clause “Alternating magnetic field”

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.

5.3.5 #2024#: IC Implementation Guideline

CQM Tag	#2024#		
CQM Requirement	5.3.5 #2024#: IC Implementation Guideline		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Activity		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): Reference to 14443-1 and -2 removed, as sufficiently addressed by EMVL		

The IC Vendor shall specify at least a minimum and a maximum reference antenna, with which, when the IC is connected to either of these antennas and integrated into a card, the resulting ICC complies with the following requirements:

- [EMVL] – EMVCo – Level 1 Specifications for Payment Systems – EMV Contactless Interface Specification
- CQM Requirements applicable to a PIC

Therefor the IC Vendor shall specify for each reference antenna:

- L: Inductance of the antenna
- C: Capacity between connection pads to the ICM or IC
- N: Number of windings
- Geometry of the antenna
- Restrictions or requirements for materials surrounding the antenna in the card

IC Requirements - Requirements applicable to the component IC

Contactless – applicable to IC having a contactless interface (“PIC”)

Where the specified IC and antenna combination is not one of the pICC classes defined in 14443-1, as may be the case in such combinations foreseen to be implemented in watches and certain tokens, such IC and antenna combination is permitted if it complies with the other requirements listed above.



Note

Being compliant with [EMVD] - EMV Book D – EMV Contactless Communication Protocol Specification instead of with [EMVL] – EMVCo – Level 1 Specifications for Payment Systems – EMV Contactless Interface Specification is permitted for some time after introduction of EMVL. Check with Mastercard’s Type Approval team for details if needed.

5.3.6 #2025#: Carrier Frequency – Operational Range

CQM Tag	#2025#		
CQM Requirement	5.3.6 #2025#: Carrier Frequency – Operational Range		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6023#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

The IC connected to an antenna shall comply with [EMVL] requirement 3.2.5.1 “Carrier Frequency $f_{s,c}$ (pICC Reception)”.

The IC vendor shall ensure that the IC conforms to this requirement when connected to each of the Reference Antenna the IC vendor has specified.

The PIL and pICC vendor shall ensure that the IC conform to this requirement when connected to any of the antenna the vendor uses as or provides for Mastercard branded products.

Product Family based sampling is recommended for checking conformity to this requirement.

Test Method: **#6023#: Operational Carrier Frequency**

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.

IC Requirements - Requirements applicable to the component IC
Contactless – applicable to IC having a contactless interface (“PIC”)

5.3.7 #2026#: Carrier Amplitude – Operational Range

CQM Tag	#2026#		
CQM Requirement	5.3.7 #2026#: Carrier Amplitude – Operational Range		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6024#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

The IC connected to an antenna shall comply with [EMVL] requirement 3.2.2.1 “Power Transfer PCD to pICC (pICC Reception)”.

The IC vendor shall ensure that the IC conforms to this requirement when connected to each of the Reference Antenna the IC vendor has specified.

The PIL and pICC vendor shall ensure that the IC conform to this requirement when connected to any of the antenna the vendor uses as or provides for Mastercard branded products.

Product Family based sampling is recommended for checking conformity to this requirement.

Test Method: **#6024#: Operational Carrier Amplitude**

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.

5.3.8 #2037#: Influence of the pICC on the Operating Field

CQM Tag	#2037#		
CQM Requirement	5.3.8 #2037#: Influence of the pICC on the Operating Field		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6033#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

The IC, when connected to any reference antenna specified by the IC Vendor, shall comply with the requirement specified in [EMVL] 3.2.3.1 “Influence of the pICC on the Operating Field”.

IC Requirements - Requirements applicable to the component IC

Contactless – applicable to IC having a contactless interface (“PIC”)

Product Family based sampling is recommended for checking conformity to this requirement.

Test method: **#6033#: Influence of the pICC on the Operating Field**

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.

5.3.9 #2027#: pICC Requirements for Power Transfer PCD to pICC

CQM Tag	#2027#		
CQM Requirement	5.3.9 #2027#: pICC Requirements for Power Transfer PCD to pICC		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6034#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

The IC Vendor shall specify the maximum power consumption via the antenna pads and ensure the IC operates as intended within this range.

The power consumption shall be specified such that the IC, when connected to any reference antenna specified by the IC Vendor, complies with the requirements specified in [EMVL] 3.2.2.1 “Power Transfer PCD to pICC (pICC Reception)”.

Product Family based sampling is recommended for checking conformity to this requirement.

Test method: **#6034#: pICC Requirements for Power Transfer PCD to**

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.



Note

Operating the IC connected to a reference antenna at H_{max} should usually reveal the IC's maximum current consumption.

5.3.10#2028#: Tolerance on Power Consumption

CQM Tag	#2028#
CQM Requirement	5.3.10 #2028#: Tolerance on Power Consumption

IC Requirements - Requirements applicable to the component IC

Contactless – applicable to IC having a contactless interface (“PIC”)

Applicable to Entity	Vendor		Subcontractor	
Applicable to Stage	Design	Qualification		Production
Applicable to CQM Products	- IC with a Contactless Interface			
Test Method	The Vendor shall define a suitable Test Method			
Default CQM Q-Plan:				
CQM Qualification	Minimum Sample Size: 8			
CQM Monitoring	8 items every Year.			

This requirement's objective is to ensure that the IC's current consumption remains somewhat within specified limits while the IC is exposed to a card reader's field, but is not operated within one of the scenarios covered by #2027#, for example after the card has been deactivated following an anti-collision selection, or after prolonged exposure to the reader's field after completion of a transaction.

The IC Vendor shall specify the maximum power consumption via the antenna pads and ensure the IC operates as intended within the specified tolerance range.

Power consumption via the antenna pads shall never exceed 110% of the nominal maximum power consumption specified by the vendor.



Note

Conformity to this requirement is typically verified at IC (Wafer) level, and not in the form of an inlay or a finished card.

It is not required that the IC is operated via an antenna while testing conformity with this requirement. Furthermore, it is recommended that to test conformity with this requirement the IC's antenna pads are connected to an adequate parametric tester.

Product Family based sampling is recommended for checking conformity to this requirement.

5.3.11 #2036#: Power-off Time

CQM Tag	#2036#		
CQM Requirement	5.3.11 #2036#: Power-off Time		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6029#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

The IC shall comply with [EMVL] Requirement 3.2.7.1 “pICC Requirements for Power-off”.

IC Requirements - Requirements applicable to the component IC
Contactless – applicable to IC having a contactless interface (“PIC”)

Product Family based sampling is recommended for checking conformity to this requirement.

Test Method: **#6029#: Power-off Time**

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.

5.3.12 #2029#: Power-on Time

CQM Tag	#2029#		
CQM Requirement	5.3.12 #2029#: Power-on Time		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6025#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

The IC shall comply with [EMVL] Requirement 3.2.8.1 “pICC Requirements for Power-on”.

Product Family based sampling is recommended for checking conformity to this requirement.

Test Method: **#6025#: Power-on Time**

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.

5.3.13 #2030#: Modulation PCD to pICC – Type A/B (pICC Reception)

CQM Tag	#2030#		
CQM Requirement	5.3.13 #2030#: Modulation PCD to pICC – Type A/B (pICC Reception)		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6030#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

IC Requirements - Requirements applicable to the component IC
Contactless – applicable to IC having a contactless interface (“PIC”)

Type A IC connected to any reference antenna specified by the IC Vendor shall comply with [EMVL] 3.3.3.1 “Modulation PCD to pICC – Type A (pICC Reception)”

Type B IC connected to any reference antenna specified by the IC Vendor shall comply with [EMVL] 3.3.5.1 “Modulation PCD to pICC – Type B (pICC Reception)”

Product Family based sampling is recommended for checking conformity to this requirement.

Test Method: **#6030#: Modulation PCD to pICC – Type A/B (pICC Reception)**

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.

5.3.14 #2031#: pICC Requirements for Load Modulation

CQM Tag	#2031#		
CQM Requirement	5.3.14 #2031#: pICC Requirements for Load Modulation		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	#6031#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

Type A and B IC connected to any reference antenna specified by the IC Vendor shall comply with [EMVL] 3.4.2.1 “Load Modulation Characteristics (pICC Transmission)”

Product Family based sampling is recommended for checking conformity to this requirement.

Test Method: **#6031#: Measurement of Load Modulation Characteristics (pICC Transmission)**

If the vendor is not able to monitor conformity with this requirement using the recommended test method, the vendor shall monitor the performance of the IC using methods and parameters to be determined by the vendor, ensuring that the IC would be compliant with the requirement if tested using the recommended test method.

5.3.15 #2032#: Input Impedance

CQM Tag	#2032#		
CQM Requirement	5.3.15 #2032#: Input Impedance		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production

IC Requirements - Requirements applicable to the component IC

Contactless – applicable to IC having a contactless interface (“PIC”)

Applicable to CQM Products	- IC with a Contactless Interface
Test Method	The Vendor shall define a suitable Test Method
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 8
CQM Monitoring	8 items every Year.

During development the IC Vendor shall characterize the range for the Input Impedance of the IC in Reception and Transmission mode at the antenna pads, such that the IC when connected to any reference antenna specified by the IC Vendor operates as intended and in conformity with [EMVL].

During production the IC Vendor shall verify the IC's electric performance such that the Input Impedance of the IC in Reception and Transmission mode at the antenna pads remains within the characterized range. The vendor shall monitor this using methods and parameters to be determined by the vendor, to ensure the produced IC are compliant with the requirement. Methods and parameters may include parametric testing and process controls.

Product Family based sampling is recommended for checking conformity to this requirement.

5.3.16 #2034#: Analog Protocol Conformity – Reference Antennas

CQM Tag	#2034#		
CQM Requirement	5.3.16 #2034#: Analog Protocol Conformity – Reference Antennas		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 0		
CQM Monitoring	None required		

The Vendor shall specify a minimum size and a maximum size reference antenna with which the IC fulfills all the relevant CQM and [EMVL] requirements, unless the IC can only operate with either a ISO/IEC 14443-1 Class 1 or a ISO/IEC 14443-1 Class 2 antenna.

The minimum size reference antenna should not be larger than a ISO/IEC 14443-1 Class 2 antenna.

The maximum size reference antenna should be at least a ISO/IEC 14443-1 Class 1 antenna.

If the IC cannot be operated with a Class 2 antenna but only with a Class 1 antenna, then the IC vendor shall specify the IC as "ISO/IEC 14443-1 Class 1 antenna only".

IC Requirements - Requirements applicable to the component IC
Contactless – applicable to IC having a contactless interface ("PIC")

If the IC cannot be operated with a Class 1 antenna but only with a Class 2 antenna, then the IC vendor shall specify the IC as "ISO/IEC 14443-1 Class 2 antenna only".

5.3.17 #2035#: Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")

CQM Tag	#2035#		
CQM Requirement	5.3.17 #2035#: Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC with a Contactless Interface - ICM with a Contactless Interface - IACICM with a Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	100% control required		

The IC shall successfully pass through the ATS or ATQ sequence as specified in the applicable versions and parts of ISO/IEC 14443-4 and [EMVL].

The IC shall provide a response as specified for the IC and its current software configuration:

- Loaded (Flash) and/or hard-coded (ROM) OS and application(s)
- Pre-personalization status
- Personalization status

The correct ATS or ATQ shall be verified before the IC, and any component or product containing it is shipped or forwarded to be incorporated into another CQM component or CQM Product, or to an issuer or cardholder.

If the device does not provide an ATS or ATQ due to its programming or loading status, e.g. if the device's non-volatile program memory has not been loaded yet and only a bootstrap loader is active within the device, then verification of a well defined and documented response relevant to the IC's current status shall be considered as compliant with this requirement.

If the correct ATS or ATQ is verified immediately after the loading of flash memory, and within the flash loading apparatus, then this shall be considered a check compliant with this requirement. Conformity with this requirement does not require an ATQ or ATS testing operation in a device physically distinct from the loading device.

6 IC Test Methods – Test Methods applicable to the component IC

This chapter defines the Test Methods applicable to the component IC.

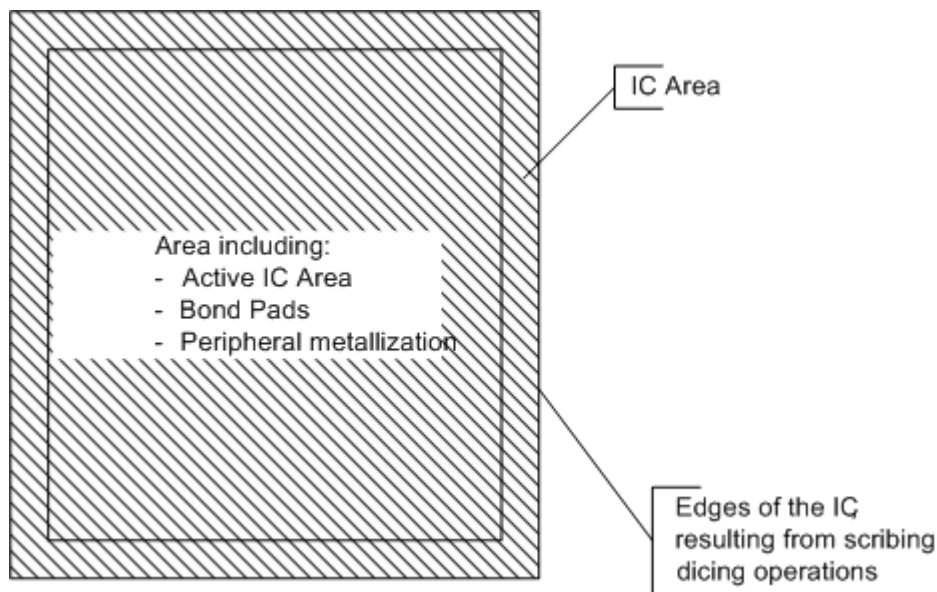
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6.1 General Test Information and Measurement Conventions

6.1.1 #6000#: IC

The *IC Area* is the area of the die determined by the result of wafer sawing (scribing/dicing). In case of multiple sawing processes, the outer edges define the *IC Area*.

Figure 1—IC-Edges



6.2 General – applicable to IC independent of the interface ("IC")

6.2.1 #6001#: IC Dimensions

CQM Tag	#6001#
CQM Test Method	6.2.1 #6001#: IC Dimensions
CQM Tag	#6001#
CQM Test Method	6.2.1 #6001#: IC Dimensions

Use this defined method to determine the IC dimensions in case:

- The design information is not available
- It cannot be ensured that the design information, submitted to the entity checking compliance, corresponds with the samples subject to testing.

6.2.1.1 Apparatus

A lateral dimension measurement device with a range sufficient to measure the lateral dimensions of the sawn IC, and an accuracy of $\pm 10\ \mu\text{m}$.

A thickness measurement device with an accuracy of $\pm 5\ \mu\text{m}$.

6.2.1.2 Procedure

1. Measure the lateral dimensions of the IC using the lateral dimension measurement device.
2. Measure the IC thickness with the thickness measurement device.

6.2.1.3 Test Report

The Test Report shall include:

- The lateral dimensions (length and width) and their ratio, and the calculated IC area.
- The measured IC thickness.

6.2.2 #6002#: Passivation Layer Integrity

CQM Tag	#6002#
CQM Test Method	6.2.2 #6002#: Passivation Layer Integrity



Note

This is an integrity test of the circuit's upper protection layers deposited over aluminum conducting patterns.

6.2.2.1 Apparatus

A white light optical microscope (for IC inspection).

A chemistry hood dedicated to acid handling (for chemical etching of the IC).

An etch capable of etching away the metallization from the surface of the IC in areas without passivation. The vendor shall choose a recipe for the etch that is suitable to execute the below procedure, specifically one that simplifies the determination of etched areas underneath the passivation due to passivation defects.



Note

The following etch might be found suitable for certain types of passivation: 40 volumes Phosphoric Acid (concentration: 85%), 19 volumes de-ionized water, 4 volumes Nitric Acid (concentration: 70%) at $50\ ^\circ\text{C} \pm 5\ ^\circ\text{C}$.



Note

For some types of passivation this etch may not be suitable, e.g. in case of antireflection coatings and pretreatment with H_2O_2 .

6.2.2.2 Procedure

1. Completely immerse the ICs in the etch for twice the amount of time required to completely remove the metallization from the surface of the IC in areas without passivation.
2. Remove etched ICs from the solution, rinse them in de-ionized water and dry them with compressed air.
3. Inspect each IC visually with the optical microscope at a magnification of $\times 150$ to determine the number of etch spots on the aluminum patterns at any location, except for intentionally un-passivated areas (pads, scribe line).

6.2.2.3 Test Report

The Test Report shall include the number of etch spots for each etched IC, the location of the observed spots (if any) and the etch-recipes used.



Note

Passivation damages induced by circuit handling during the integrity test shall not be considered etch spots if their handling origin is assured.

6.2.3 #6003#: IC Backside Roughness

CQM Tag	#6003#
CQM Test Method	6.2.3 #6003#: IC Backside Roughness

6.2.3.1 Apparatus

Use a roughness measurement device in accordance with ISO 5436-1 and 5436-2 (geometric product specification – Part 1 measurement standards and part 2 – soft gauges) or equivalent.

Other methods, particularly those based on 3D imaging analysis with correct calibration, may also be used instead.

6.2.3.2 Procedure

1. Determine the characteristics corresponding to the Requirement in accordance with ISO 5436-1 and -2 or equivalent.

6.2.3.3 Test Report

The Test Report shall report the characteristics related to the Requirement and equipment used.

6.2.4 #6004#: IC Visual Aspects

CQM Tag	#6004#
CQM Test Method	6.2.4 #6004#: IC Visual Aspects

This method defines the means and methods for visual inspection of the active surface and backside of an IC or wafer, and the Wafer Support.



Note

For IC surface examination, only the most superficial layers are reliably inspected for current modern production technologies.

6.2.4.1 Apparatus

For active surface and backside inspection:

- See MIL883 method 2010 and JEDEC JESD22b118

For Wafer Support inspection:

- Bare eye with proper lighting

6.2.4.2 Procedure

Examination of the active IC surface:

1. Inspect the required number of samples in accordance with method 2010 defined in MIL883K or later.

Examination of the IC backside:

2. Inspect the backside of the IC or wafer in accordance with method JEDEC JESD22-B118.

Examination of the Wafer Support:

3. Inspect Wafer Support for silicon particles originating from the wafer.

6.2.4.3 Test Report

The Test Report shall include a list and pictures of the critical defects found (if any).

6.2.5 #6006#: Die Flex Stress Test

CQM Tag	#6006#
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CQM Test Method	6.2.5 #6006#: Die Flex Stress Test
Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): Clarified that both sides shall be tested.

6.2.5.1 Apparatus

A holding mechanism for the test sample in line with **Figure 2—Die Strength Testing Principle**, consisting of a flat rigid plate with a gap underneath the test sample ((1) and (2) in **Figure 2—Die Strength Testing Principle**). The length of the gap shall be 0.2 mm to 0.4 mm less than the length L of the test sample.

A force application mechanism consisting of an anvil having a cylindrical surface facing the test sample, in line with **Figure 2—Die Strength Testing Principle** and the anvil shall have a Width W1 greater than the width W of the test sample.

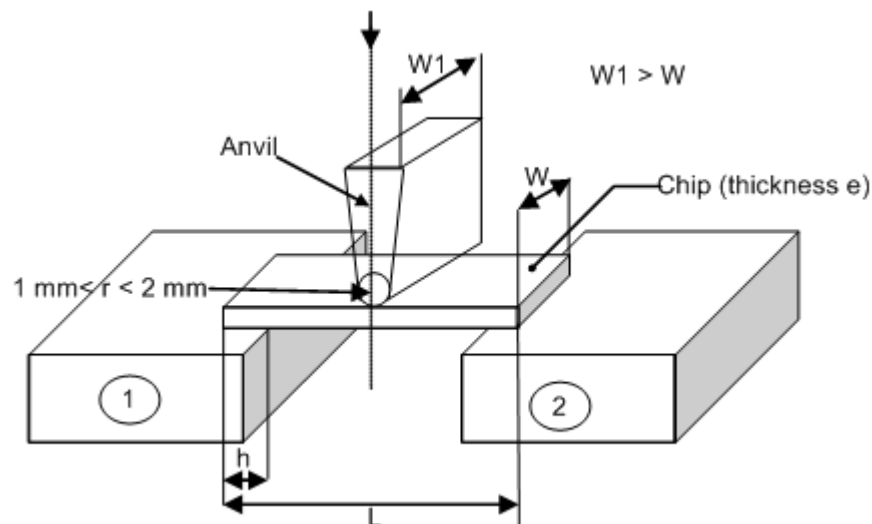
The force application mechanism shall be capable of gradually increasing the force applied to the die, and shall have the capability to measure the maximum force.



Note

The 'length' L of the test sample is the greater of the two horizontal dimensions of the test sample, the 'width' W is the smaller one. The vertical dimension is the 'thickness' e.

Figure 2—Die Strength Testing Principle



6.2.5.2 Procedure

1. Place the die on the base plate such that the die's length spans the gap in the level rigid plate, and the die's shorter sides rest on the level rigid plate, overlapping it for 0.1 mm to 0.2 mm (measure h in **Figure 2—Die Strength Testing Principle**).

2. Position the anvil over the center of the die, with the length of the anvil parallel to the short sides of the die, and extends over the full width of the test sample.
3. Gradually increase the force the anvil applies to the die while continually measuring the force until the die breaks.
4. Determine the maximum force F_{max} applied to the test sample.
5. Calculate the pressure S from the various dimensions and the maximum force F_{max} :
 - F_{max} : measured maximum force in Newton
 - L : length of the test sample
 - W : width of the test sample
 - e : thickness of the test sample
 - h : length of chip resting on the supporting flat rigid plate

using the formula:

$$S = \frac{3}{2} \times F_{max} \times \frac{L - 2h}{W \times e^2}$$

6. Repeat the procedure with another IC this time with the opposite side facing up.

6.2.5.3 Test Report

The report shall report for the test sample the linear dimensions and the pressure S for each side (active side and backside) of the IC.

6.2.6 #6008#: X-Rays [IS10373-1]



Note

CQM Tag	#6008#
CQM Test Method	6.2.6 #6008#: X-Rays [IS10373-1]

Specific sanitization references are out of CQM's scope and shall be tested specific to each country of issuance according to the relevant specifications.

6.2.6.1 External method:

Use the method "X-rays" from ISO/IEC 10373-1.

6.3 Contact – applicable to IC having a contact interface IC ("IC-K")

6.3.1 #6009#: Electrostatic Discharges (ESD) [IS10373-1]

CQM Tag	#6009#
CQM Test Method	6.3.1 #6009#: Electrostatic Discharges (ESD) [IS10373-1]

6.3.1.1 External Method

Use the following method, but with the modifications defined here under, to determine compliance with the Requirement:

ANSI/ESDA/JEDEC JS-001¹⁰, with the following additional conditions:

- If an IC is tested, IC contacts that are not/will not be connected to the IC Card Contacts shall not be tested.
- If an ICM/ICC is tested, IC Card contacts that are not connected to the IC shall not be tested.
- If an ICC is tested where parts of the antenna are exposed to the card’s outside, this antenna shall be tested like an additional contact.
- Each VCC and GND contact shall be considered a Supply Pin in the sense of JS-001. When one of these is connected to Terminal B of the test apparatus, all other contacts including all other supply pins shall be tested by connecting them one at a time to Terminal A of the test apparatus, with all other pins remaining float.

6.3.2 #6012#: Latch-up

CQM Tag	#6012#
CQM Test Method	6.3.2 #6012#: Latch-up

6.3.2.1 Sampling Parameters:

Test at least one sample for its ability:

- To pass the complete sequence (2×Overcurrent, Over-voltage)
- To pass over-current positive
- To pass over-current negative
- To pass over-voltage

Keep the detail results for reference.

6.3.2.2 External Method:

The following method, but with the modifications defined here under, shall be used to determine compliance with the Requirement:

¹⁰ Given that the 2018 version of IEC 60749-26 references JS-001’s 2017 version, CQM Editor assumes that this will be the main standard defining the HBM ESD test in future. The current version at the time this standard is published is JS-001-2017. IEC 60749-26 may be used as the base for this test until the end of 2020.

Electronic Industries Association, EIA/JEDEC Standard, EIA/JESD78, "IC Latch-Up Test" in its current version. The current version at the time this document is published is 2016-04.

Modifications:

To test the IC before and after exposure, perform the following Test Method:

- VCC Contact ("VCC")
- I/O contact
- CLK Contact
- RST contact

6.3.3 #6013#: Max Input Voltage Ratings - Contact Pads

CQM Tag	#6013#
CQM Test Method	6.3.3 #6013#: Max Input Voltage Ratings - Contact Pads

Apply the voltage defined in the requirement for a duration of 30 sec.

Verify functionality after exposure.

6.3.4 #6017#: VPP Contact ("VPP")

CQM Tag	#6017#
CQM Test Method	6.3.4 #6017#: VPP Contact ("VPP")

Verify in the Product Specification that the IC does not require Vpp.

6.3.5 #6018#: VCC Contact ("VCC")

CQM Tag	#6018#
CQM Test Method	6.3.5 #6018#: VCC Contact ("VCC")

The purpose of this test is to measure the current consumed by the ICC on the VCC contact and to check if the ICC runs with the specified voltage ranges (see [EMVK] sections 5.3.6 and 3.).

6.3.5.1 External Method

Use the following method to determine compliance with the Requirement:

[IS10373-3] Section 5.1.

6.3.5.2 Test Report

Report the values determined in the procedure and whether all communications were in conformance with [EMVK].

6.3.6 #6019#: CLK Contact

CQM Tag	#6019#
CQM Test Method	6.3.6 #6019#: CLK Contact

The purpose of this test is to measure the current consumed by the ICC on the CLK contact and to check if the ICC runs with the specified clock frequencies and waveforms (see [EMVK] sections 5.3.4 and 3.).

6.3.6.1 External Method

Use the following method determine compliance with the Requirement:

[IS10373-3] Section 5.3.

6.3.6.2 Test Report

Report the capacitance of the CLK-contact, the values determined in the procedure and whether all communications were in conformance with [EMVK].

6.3.7 #6020#: I/O Contact

CQM Tag	#6020#
CQM Test Method	6.3.7 #6020#: I/O Contact

The purpose of this test is to measure the contact capacitance of the I/O contact, the I/O output voltages (VOH, VOL) under normal operating conditions (IOL max/min and IOH max/min), I/O tR and tF during transmission mode of the ICC and the I/O input current (IIL) during reception mode of the ICC.

6.3.7.1 External Method

Use the following method to determine compliance with the Requirement:

[IS10373-3] Section 5.2

6.3.7.2 Test Report

Report the capacitance of the I/O-contact, the values determined in the procedure and whether all communications were in conformance with [EMVK].

6.3.8 #6021#: RST Contact

CQM Tag	#6021#
CQM Test Method	6.3.8 #6021#: RST Contact

The purpose of this test is to check if the ICC runs with the allowed min and max timing values and voltages of an RST signal (see [EMVK] section 1.2.5, 2.1.2 and 2.1.3).

6.3.8.1 External Method

Use the following method to determine compliance with the Requirement:

[IS10373-3] Section 5.4

6.3.8.2 Test Report

The test report shall state the capacitance of the RST-contact, the values determined in the procedure and whether all communications were in conformance with [EMVK].

6.3.9 #6022#: Parametric Electrical Characteristics -Test Methods using ATE (Contact)

CQM Tag	#6022#
CQM Test Method	6.3.9 #6022#: Parametric Electrical Characteristics -Test Methods using ATE (Contact)

In previous releases of this standard, a dedicated test method for verifying conformity with #2012# to #2017# was defined here. This method has been removed. Instead the following rules apply to the use of ATE to verify conformity of IC with #2012# to #2017#:

- Vendors are permitted to use ATE for qualification and production monitoring testing, e.g. 100% control at the end of IC production.

- Vendors are free to select and/or develop their own test methods and programs for the use of such ATE equipment, as long as the vendor can demonstrate that the methods and programs used to determine conformity with #2012# to #2017# with at least the same level of scrutiny as the methods #6018# to #6021#.

6.4 Contactless – applicable to IC having a contactless interface ("IC-L")

6.4.1 #6010#: ESD Robustness to HBM at Antenna Pads

CQM Tag	#6010#
CQM Test Method	6.4.1 #6010#: ESD Robustness to HBM at Antenna Pads

6.4.1.1 External Method

Use the following method, but with the modifications defined below, to determine compliance with the Requirement:

ANSI/ESDA/JEDEC JS-001¹¹, with the following additional conditions:

- If an IC is tested, IC contacts that are not intended to be connected to the antenna shall not be tested.
- If an ICM is tested, only IC Card contacts that will be connected to the antenna shall be tested.
- For ICM with an integrated antenna not exposed to the card surface, the test shall be conducted on the antenna.
- The test is not applicable to ICC with the antenna already connected.

6.4.2 #6016# ESD Robustness to CDM at Contact Pads – IC connected to antenna in ICC

CQM Tag	#6016#
CQM Test Method	6.4.2 #6016# ESD Robustness to CDM at Contact Pads – IC connected to antenna in ICC

¹¹ Given that the 2018 version of IEC 60749-26 references JS-001's 2017 version, CQM Editor assumes that this will be the main standard defining the HBM ESD test in future. The current version at the time this standard is published is JS-001-2017. IEC 60749-26 may be used as the base for this test until the end of 2020.

6.4.2.1 External Method

Use the method defined in the latest draft, or the version published after 2018, of ISO/IEC 10373-1, Annex B “ESD Sensitivity of cards to CDM”.

6.4.3 #6015#: Alternating Magnetic Fields (ISO 14443-1)

CQM Tag	#6015#
CQM Test Method	6.4.3 #6015#: Alternating Magnetic Fields (ISO 14443-1)

The vendor shall use the test method “pICC tests” - “Alternating Magnetic Field” defined in [IS10373-6].

6.4.4 #6023#: Operational Carrier Frequency

CQM Tag	#6023#
CQM Test Method	6.4.4 #6023#: Operational Carrier Frequency

Use the test method defined in [EMVL] clause 3.2.2 “pICC Requirements for Power Transfer PCD to pICC” and verify the IC connected to the antenna is fully functional under the following conditions:

- $F_{S,c} = \text{Min}$, $V_{S,OV} = \text{Nom}$, ICC placed at ($r=0$, $\phi=0$, $z=4$ cm, $\theta=0$)
- $F_{S,c} = \text{Min}$, $V_{S,OV} = \text{Nom}$, ICC placed at ($r=0$, $\phi=0$, $z=0$ cm, $\theta=0$)
- $F_{S,c} = \text{Max}$, $V_{S,OV} = \text{Nom}$, ICC placed at ($r=0$, $\phi=0$, $z=4$ cm, $\theta=0$)
- $F_{S,c} = \text{Max}$, $V_{S,OV} = \text{Nom}$, ICC placed at ($r=0$, $\phi=0$, $z=0$ cm, $\theta=0$)

Alternatively, when testing the IC without an antenna connected, a signal may be emulated equivalent to that experienced by an IC connected to an antenna while exposed to the above test scenarios.

6.4.5 #6024#: Operational Carrier Amplitude

CQM Tag	#6024#
CQM Test Method	6.4.5 #6024#: Operational Carrier Amplitude

Use the test method defined in [EMVL] clause 3.2.2 “pICC Requirements for Power Transfer PCD to pICC” and verify the IC connected to an antenna is fully functional under the following conditions:

- $F_{S,c} = \text{Nom}$, $V_{S,OV} = \text{Min}$, ICC placed at ($r=0$, $\phi=0$, $z=4$ cm, $\theta=0$)
- $F_{S,c} = \text{Nom}$, $V_{S,OV} = \text{Max}$, ICC placed at ($r=0$, $\phi=0$, $z=0$ cm, $\theta=0$)

Alternatively, when testing the IC without an antenna connected, an equivalent signal may be emulated to that experienced by an IC connected to an antenna while exposed to the above test scenarios.

6.4.6 #6033#: Influence of the pICC on the Operating Field

CQM Tag	#6033#
CQM Test Method	6.4.6 #6033#: Influence of the pICC on the Operating Field

The vendor shall use the test method defined in [EMVL] 3.2.3 “Influence of the pICC on the Operating Field”.

6.4.7 #6034#: pICC Requirements for Power Transfer PCD to pICC

CQM Tag	#6034#
CQM Test Method	6.4.7 #6034#: pICC Requirements for Power Transfer PCD to pICC

The vendor shall use the test method defined in [EMVL] 3.2.2 “pICC Requirements for Power Transfer PCD to pICC”.

Operating the IC connected to a reference antenna at H_{\max} should usually reveal the IC’s maximum current consumption.

6.4.8 #6029#: Power-off Time

CQM Tag	#6029#
CQM Test Method	6.4.8 #6029#: Power-off Time

The vendor shall use the test method defined in [EMVL] 3.2.7 “pICC Requirement for Power-off”.

6.4.9 #6025#: Power-on Time

CQM Tag	#6025#
CQM Test Method	6.4.9 #6025#: Power-on Time

The vendor shall use the test method defined in [EMVL] 3.2.8 “pICC Requirement for Power-on”.

6.4.10 #6030#: Modulation PCD to pICC – Type A/B (pICC Reception)

IC Test Methods – Test Methods applicable to the component IC
Contactless – applicable to IC having a contactless interface (“IC-L”)

CQM Tag	#6030#
CQM Test Method	6.4.10 #6030#: Modulation PCD to pICC – Type A/B (pICC Reception)

For Type A IC use the test method defined in [EMVL] 3.3.3 “Modulation PCD to pICC – Type A (pICC Reception)”.

For Type B IC use the test method defined in [EMVL] 3.3.5 “Modulation PCD to pICC – Type B (pICC Reception)”.

6.4.11 #6031#: Measurement of Load Modulation Characteristics (pICC Transmission)

CQM Tag	#6031#
CQM Test Method	6.4.11 #6031#: Measurement of Load Modulation Characteristics (pICC Transmission)

Use the test method defined in [EMVL] 3.4.2 “pICC Requirements for Load Modulation”.

Part D

Product Requirements and Test Methods for the ICM Vendor

7 ICM Requirements - Requirements applicable to the component ICM

This chapter defines the Product Requirements applicable to the component ICM, some of which are also applicable to IL, , and IAC.

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7.1 General – applicable to ICM independent of the interface ("ICM")

7.1.1 #2501#: ICM - Construction and Specification

CQM Tag	#2501#		
CQM Requirement	7.1.1 #2501#: ICM - Construction and Specification		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any ICM Activity - Any IACICM Activity - any Biometric Sensor Module		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

The ICM shall be produced by combining the IC and the contact plate using adequate technologies.

The ICM shall be well defined and documented, including:

- IC
- Interconnection technologies and materials
- Encapsulation technologies and materials
- Manufacturing processes and parameters (explicitly in the specification or by reference to documents defining the processes)
- Test Processes and Criteria (explicitly or by reference e.g. to a QC Plan)
- Qualification Criteria (explicitly or by reference e.g. to a Qualification Plan)

The vendor shall specify the ICM and document the specification. Examples for acceptable forms for a specification are written documents, tables listing requirements and product details, and parts lists in ERP systems.



Note

The Vendor is required to specify the above information in its internal documentation. This does not constitute a requirement to communicate this information to the vendor's client.

Test Method: no test method.

7.1.2 #2502#: ICM and IL - Reference Implementation and Mechanical Robustness

CQM Tag	#2502#		
CQM Requirement	7.1.2 #2502#: ICM and IL - Reference Implementation and Mechanical Robustness		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production

ICM Requirements - Requirements applicable to the component ICM
General – applicable to ICM independent of the interface (“ICM”)

Applicable to CQM Products	- Any ICM Activity - Any Inlay Activity - Any IACICM Activity - any Biometric Sensor Module - Any IACIL
Test Method	The Vendor shall define a suitable Test Method
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 42
CQM Monitoring	None required



Note

In the text of this requirement the terms “ICM or IL” and “ICM and IL” represent all components and products this requirement applies to. The term “ICM or IL” includes iacICM, BSM, and iacIL.

The ICM or IL Vendor shall demonstrate as part of product qualification through producing and qualifying a well-defined ICC containing the ICM or IL using a well-defined production process that it is possible to produce an ICC complying with the relevant CQM requirements for cards. The vendor may use blank white cards, or cards with any other artwork to produce the test cards.

The different materials forming the ICM or IL structure shall sufficiently adhere to each other to avoid mechanical reliability problems of the ICM or IL.

Compliance to this requirement is met if, upon visual inspection using a x10 magnifier, there are no signs of delamination, and the ICM or IL together with any connected functional elements inside the card the ICM is embedded into, such as an antenna, remain fully functional, after carrying out the following tests:

For all ICM and IL:

Requirement	Samples
#3042#: Dynamic Bending Stress [IS7810]	8
#3043#: Dynamic Torsional Stress	8
#3046#: Resistance to Chemicals for ICM that are exposed on the surface of the card	1 per solution (10 total)

ICM Requirements - Requirements applicable to the component ICM
General – applicable to ICM independent of the interface ("ICM")

And for all ICM and IL containing an IC:

Requirement	Samples
#3054#: 3 wheel Test Robustness , or #3057#: 3 wheel Test Robustness for Interactive Cards ("IAC") and ICC made without an ICM , depending on the location of the IC(s). For the Reference Implementation of an ICM only the location of the ICM shall be subjected to the 3 Wheel test. For the Reference Implementation of an IL the MSAs that are part of the IL, eg ICs, shall be subject to the 3 Wheel test.	8
#3055#: Wrapping Test Robustness	8

And for iacICM, BSM and iacIL containing a fingerprint sensor:

Requirement	Samples
#2043#: Functional Verification of Biometric Sensors	70
#2039#: Fingerprint Sensor – Pressure Test	8
#2040#: Fingerprint Sensor – Service Life	8
#2041#: Fingerprint Sensor – Resistance to Abrasion	8
#2042#: Fingerprint Sensor – Resistance to Scratching	8
#3057#: 3 wheel Test Robustness for Interactive Cards ("IAC") and ICC made without an ICM	8
#3068#: Wrapping Test Robustness for IAC	8

Verification of the ICM or IL being fully functional shall include testing before and after for ICM and IL with a contact interface:

- **#2018#: Answer-to-Reset ("ATR")**

and testing before and after for ICM and IL with a contactless interface:

- **#3061#: Verification of Antenna Functionality, and Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")**

ICM Requirements - Requirements applicable to the component ICM

General – applicable to ICM independent of the interface (“ICM”)

- **#3062#: Resonance Frequency**
- **#3063#: Q-Factor**
- **#3064#: Reading Distance**

And verifying that the contact and contactless performance has not significantly degraded.

Each test shall be conducted with a sample size of at least the number of ICM defined above, except resistance to chemicals, which shall be conducted with at least 1 ICM per solution. Resistance to chemicals testing shall include exposure to Salt Mist.

To conduct some of the qualification tests, the ICM shall be embedded into a card.

If during qualification testing of the ICM or IL, the test cards with the embedded ICM fail during qualification testing by the Vendor, e.g. after the dynamic bending test the connection between the ICM and an antenna embedded into the card has failed, then the ICM or IL has not passed the qualification test, even though the antenna connection might technically not be part of the ICM or the IL. It is the ICM or IL provider's responsibility to demonstrate that at least one card construction that passes these tests can be manufactured with the ICM or IL.

Product Family based sampling is recommended for Monitoring to reduce the testing effort and the Vendor is permitted to limit monitoring to High Runners only. Qualification data from ICM or IL from the same product family obtained during the preceding interval may be used as monitoring data for that product family. The vendor is permitted to skip monitoring for low running and end-of-life products.



Note

If the vendor uses multiple lots of identical products for qualification, the sample size required shall be at least the total number of devices tested. The vendor is not required to test the required number of samples from every lot.

The Vendor may re-use test data obtained from their customers.

If the Vendor is unable to demonstrate a compliant reference implementation, the ICM shall not be considered qualified.

7.1.3 #2503#: Temperature and Humidity Exposure

CQM Tag	#2503#		
CQM Requirement	7.1.3 #2503#: Temperature and Humidity Exposure		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any ICM Activity - Inlay produced using an unpackaged IC - Any IACICM Activity - any Biometric Sensor Module		
Test Method	#8092#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 50		

ICM Requirements - Requirements applicable to the component ICM
General – applicable to ICM independent of the interface (“ICM”)

CQM Monitoring	20 items every 3rd Month.
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The compliance with the requirement shall be determined by exposing the ICM to Temperature and Humidity Exposure at 85 °C and 85 % RH.

Product Family based sampling is recommended for Monitoring to reduce the testing effort and the Vendor is permitted to limit monitoring to High Runners only.

Test method: **8.1.1 #8092#: Temperature and Humidity Exposure**

7.1.4 #2514#: Temperature Cycling

CQM Tag	#2514#		
CQM Requirement	7.1.4 #2514#: Temperature Cycling		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any ICM Activity - Inlay produced using an unpackaged IC - Any IACICM Activity - any Biometric Sensor Module		
Test Method	#8093#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 50		
CQM Monitoring	20 items every 3rd Month.		

The compliance with the requirement shall be determined by exposing the ICM to Temperature Cycling, air to air, between -40 °C and +85 °C.

Product Family based sampling is recommended for Monitoring to reduce the testing effort and the Vendor is permitted to limit monitoring to High Runners only.

Test method: **8.1.2 #8093#: Temperature Cycling**

7.1.5 #2515#: Loading of Software into IC, ICM, IL, or card before personalization

CQM Tag	#2515#		
CQM Requirement	7.1.5 #2515#: Loading of Software into IC, ICM, IL, or card before personalization		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<ul style="list-style-type: none">- Any IC Activity- Any ICM Activity- Inlay produced using an unpackaged IC- Inlay produced using a packaged IC, eg an ICM- Any IC Card- Any IACICM Activity- any Biometric Sensor Module- Any InterActive Card		

ICM Requirements - Requirements applicable to the component ICM

General – applicable to ICM independent of the interface (“ICM”)

Test Method	The Vendor shall define a suitable Test Method
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 1
CQM Monitoring	1 item every Batch.

7.1.5.1 Introduction

This requirement applies to vendors who are loading software (OS, program code, data, subsequently collectively referred to as “SW”) into IC, ICM, IL, or cards prior to personalization. Vendors who are not loading SW into ICM or IL may ignore this requirement.



Note

To improve readability of this requirement, the subsequent text only mentions Device, but the reader shall understand “Device” to refer to IC, ICM, various types of IL, and cards prior to personalization.

This requirement addresses the process from the Vendor receiving the SW until the packaging of Device, with the following steps:

- Receipt
- Storage
- Processing into Production Files
- Qualification
- Production
- Packaging

7.1.5.2 Receipt

Verify receipt of the correct SW:

- If the transfer of the SW to the vendor involves 3-rd party systems, such as Courier, E-Mail, or file sharing services, then the vendor shall verify the integrity of the received SW, e.g. by verifying a checksum of the SW file.
- The vendor shall offer confidential means of transfer, e.g. the use of end-to-end encryption.



Note

Verifying receipt of the correct SW is not required if there is no transfer over 3rd party systems involved in transferring the SW to the site, as would be the case if the loading site obtains the SW from a database shared with the Vendor’s SW developing department, and the database has built-in means of ensuring integrity of the SW.

Identify the SW upon receipt:

- The vendor shall uniquely identify the SW upon receipt, e.g. with a unique article number, and/or with a unique name.

7.1.5.3 Storage

While storing the SW on site, the Vendor shall ensure that storage protects the SW:

- against unauthorized disclosure and modification by limiting access to the file(s) containing the SW on a need to know basis, and optionally by employing encryption; and
- against loss through an adequate back-up and restore system.

7.1.5.4 Processing SW into production files

If the vendor processes the SW, e.g. to combine it with loading scripts into a dedicated file for an SW programming machine, the vendor shall uniquely identify the resulting modified SW such that it can be distinguished from the SW before it was processed, as well as from different versions and variants of the processed SW.

7.1.5.5 Qualification

The Vendor shall qualify the SW before starting to load it in volume to ensure that the SW is as intended, especially each time after the vendor has processed the SW, e.g. to combine it with loading scripts into a dedicated file for an Device programming machine.

Through adequate testing the vendor shall verify that the correct SW has been loaded into the Device.

The Vendor shall qualify the production set-up with the final set of SW that the Vendor intends to load into the Device. This qualification shall comprise:

- verifying that the SW loaded into the Device is the intended SW, and
- a verification independent of the production personnel,
- in addition, if loading SW is provided as a service for an external client, qualification shall involve a formal acceptance by the client.

7.1.5.6 Production

Identification of the SW to be loaded:

- At least for every production batch, the Vendor shall precisely specify for the personnel operating the Device loading machine which SW to load into the Device

Selecting the SW to be loaded:

- The Vendor shall provide to the Vendor's staff systems that support a selection of the correct SW with a low risk of error, e.g. by providing the SW coded in a barcode so that mistypings of SW file names, or misselection from lists of multiple types of SW cannot cause the loading of the wrong SW into the Device.

- The Vendor shall verify that the correct SW was selected for loading prior to loading the SW into the first Device by a member of staff independent from the operator selecting the SW.

Verifying that the correct SW was loaded into the Device:

- Through testing of a loaded ICM the Vendor shall verify that the correct SW has been loaded into the ICM. The details depend on the SW and the configuration of the ICM, but at least the correct ATR shall be verified.

7.1.5.7 Identification and packaging

The Vendor shall identify the Device packaging unit (for example an ICM reel) and the Device packaging (box around the Device reel) with a unique identifier identifying the combination of the Device and the SW.

The unique identifier shall fulfill the following requirements:

- The identification of the Device with the loaded SW shall differ from the identification of the Device without the SW loaded.
- The identification of the Device with the loaded SW shall differ from the identification of the same Device loaded with different SW. "Different SW" for example would mean a different version of the SW.

Labelling of devices where feasible (e.g. on an ICM reel), and on the packaging of the Devices (box) shall show this unique identifier.

A unique identifier would be for example an article number for the Device with the loaded SW, that differs from the article number for the Device without the loaded SW, and from the article numbers of the same Device but loaded with different versions of the SW.

7.2 Contact – applicable to ICM having a contact interface IC ("KICM")

7.2.1 #2505#: Surface Profile of Contacts [IS7816-1]

CQM Tag	#2505#		
CQM Requirement	7.2.1 #2505#: Surface Profile of Contacts [IS7816-1]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any ICM Activity - Inlay with 7816-2 contacts - IACICM with a Contact Interface - Inlay with 7816-2 contacts		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	2 items every Week.		

The contact surface of the module shall not show any visible damage from the production processes, e.g. scratches and dents.

The ICM provider shall demonstrate during qualification that ICC can be produced with the ICM that comply with requirement **11.2.2 #3059#: Relative Height of Contacts**

The samples produced to determine conformity with **7.1.2 #2502#: ICM and IL - Reference Implementation and Mechanical Robustness** may be used to determine conformity during qualification.

During production, the ICM provider shall monitor the flatness of the ICM using adequate methods to ensure that the module flatness remains close to that of the ICM of the qualification lot, e.g. through visual inspection on a rigid, flat plate: or placing the ICM on a rigid flat plate with groves for the encapsulation simulating the cavity inside the card, and measuring the flatness with a profilometer or a thickness indicator.

7.2.2 #2506#: Electrical Resistance of Contacts – prior to environmental and chemical exposure testing [IS7810]

CQM Tag	#2506#		
CQM Requirement	7.2.2 #2506#: Electrical Resistance of Contacts – prior to environmental and chemical exposure testing [IS7810]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM with a Contact Interface - Inlay with 7816-2 contacts - IACICM with a Contact Interface - Inlay with 7816-2 contacts - IAC having a Contact Interface		
Test Method	IS10373-1		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

ICM Requirements - Requirements applicable to the component ICM

Contact – applicable to ICM having a contact interface IC (“KICM”)

The resistance between two points on the surface of each contact shall be less than 0.5 Ω for an ICM that has not been exposed to a corrosive environment.

Product Family based sampling is recommended for Monitoring to reduce the testing effort and the Vendor is permitted to limit monitoring to High Runners only.



Note

The “Electrical resistance of contacts” represents the electrical surface resistance of the contacts from the module under low voltage DC-conditions.

7.2.3 #2507#: Electrical Resistance of Contacts – following exposure to Temperature and Humidity

CQM Tag	#2507#		
CQM Requirement	7.2.3 #2507#: Electrical Resistance of Contacts – following exposure to Temperature and Humidity		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM with a Contact Interface - Inlay with 7816-2 contacts - IACICM with a Contact Interface - Inlay with 7816-2 contacts - IAC having a Contact Interface		
Test Method	#8092# IS10373-1		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		

The resistance between two points on the surface of each contact shall be less than 1.0 Ω after the ICM has been exposed to 85 °C \pm 5 °C and 85% r.H. \pm 5% r.H. for 168 h as defined in #8092# but without bias during exposure being required. The time between the end of TH exposure and the measurement of the resistance shall exceed 4 hours.

Product Family based sampling is recommended for Monitoring to reduce the testing effort and the Vendor is permitted to limit monitoring to High Runners only.

7.2.4 #2513#: Electrical Resistance of Contacts – following exposure to Salt Mist

CQM Tag	#2513#		
CQM Requirement	7.2.4 #2513#: Electrical Resistance of Contacts – following exposure to Salt Mist		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<ul style="list-style-type: none">- ICM with a Contact Interface- Inlay with 7816-2 contacts- IACICM with a Contact Interface- Inlay with 7816-2 contacts- IAC having a Contact Interface		

ICM Requirements - Requirements applicable to the component ICM

Contact – applicable to ICM having a contact interface IC (“KICM”)

Test Method	IS10373-1
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 8
CQM Monitoring	8 items every Year.

The resistance between two points on the surface of each contact shall be less than 1.0 Ω after the ICM has been exposed to salt mist for 24 h as defined in ISO/IEC 10373-1. The time between the end of salt mist exposure and the measurement of the resistance shall exceed 4 h.

Long term exposure to chemicals, e.g. salt mist exposure or certain gases in the surrounding atmosphere, may result in discolorations to the contact surface. Where such discolorations occur in the Minimum Contact Areas, the Vendor shall demonstrate as part of the qualification process that these discolored areas do not cause the surface resistance of any ISO/IEC 7816-2 contact to exceed 1.0 Ω .

Product Family based sampling is recommended for Monitoring to reduce the testing effort and the Vendor is permitted to limit monitoring to High Runners only.

7.2.5 #2508#: Contact Layout - Minimum Contact Areas

CQM Tag	#2508#		
CQM Requirement	7.2.5 #2508#: Contact Layout - Minimum Contact Areas		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM with a Contact Interface - Inlay with 7816-2 contacts - IACICM with a Contact Interface - Inlay with 7816-2 contacts - IAC having a Contact Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

The contacts of the ICM, the ICC shall be compliant with [EMVK], and hence compliant with ISO/IEC 7816-2.

In case of ICM for producing Dual Interface Cards there might be additional contact areas on the reverse side of the module for the connection to the antenna in the CB. These contact areas are out of the scope of this document. According to the electrical connection technology of choice the embedder shall ensure a reliable conductive path between the ICM and the antenna for all ICCs produced. The reliability of the resulting ICC shall be tested on ICC level.

Figure 3—Minimum Contact Areas defines the size, location and name of each of the eight Minimum Contact Areas.

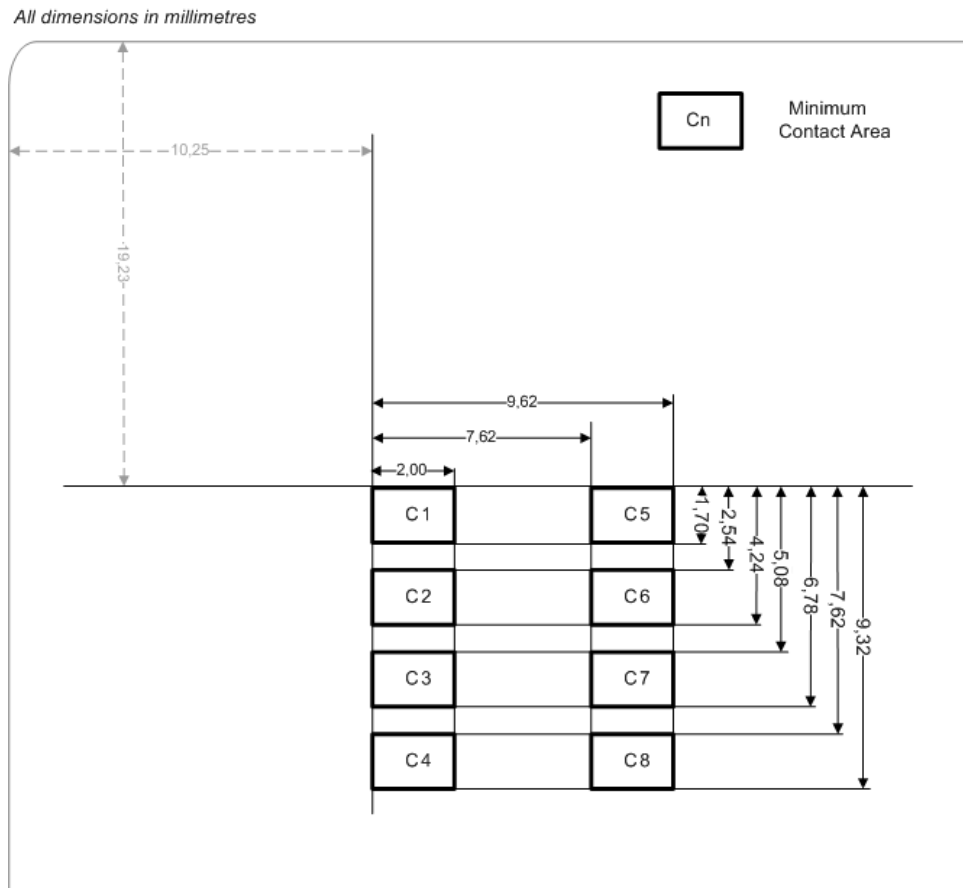
ICM Requirements - Requirements applicable to the component ICM
Contact – applicable to ICM having a contact interface IC (“KICM”)

Distinct conductive surfaces shall fully cover the Minimum Contact Areas C1, C2, C3, C5 and C7. The Minimum Contact Area C6 is optional; it shall either be fully covered by a distinct conductive surface or by no conductive surface at all. The Minimum Contact Areas C4 and C8 are optional, and distinct conductive surfaces may partially or fully cover them.

The conductive surfaces covering the Minimum Contact Areas are subsequently called Physical Contacts. An individual Physical Contact is referred to by the term Physical Contact Pn, while Cn is the name of the corresponding Minimum Contact Area.

Product Family based sampling is recommended for Monitoring to reduce the testing effort and the Vendor is permitted to limit monitoring to High Runners only. For this specific requirement, a Product Family are ICM sharing the same ICM tape or lead frame.

Figure 3—Minimum Contact Areas



To determine conformity with this requirement, the vendor shall define an adequate test method. The test method shall verify that the physical contacts fully cover the Minimum Contact Areas.

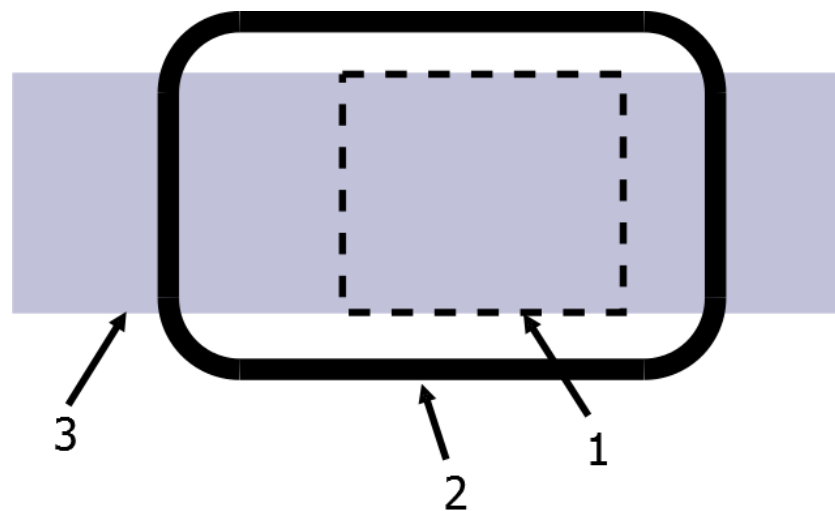
7.2.6 Contact Layout for ICC

7.2.6.1 Definitions

The following shall be defined for each ICM, ICC in addition to the Minimum Contact Area:

- **Figure 4—Definition of Restricted Area** defines the Restricted Area around a Minimum Contact Location

Figure 4—Definition of Restricted Area Rn



Legend:

- 1: ISO 7816-2 Minimum Contact Area Cn (broken line)
- 2: Physical contact Pn corresponding to Minimum Contact Area Cn (continuous line)
- 3: Restricted Area Rn corresponding to Minimum Contact Area Cn (grey area)

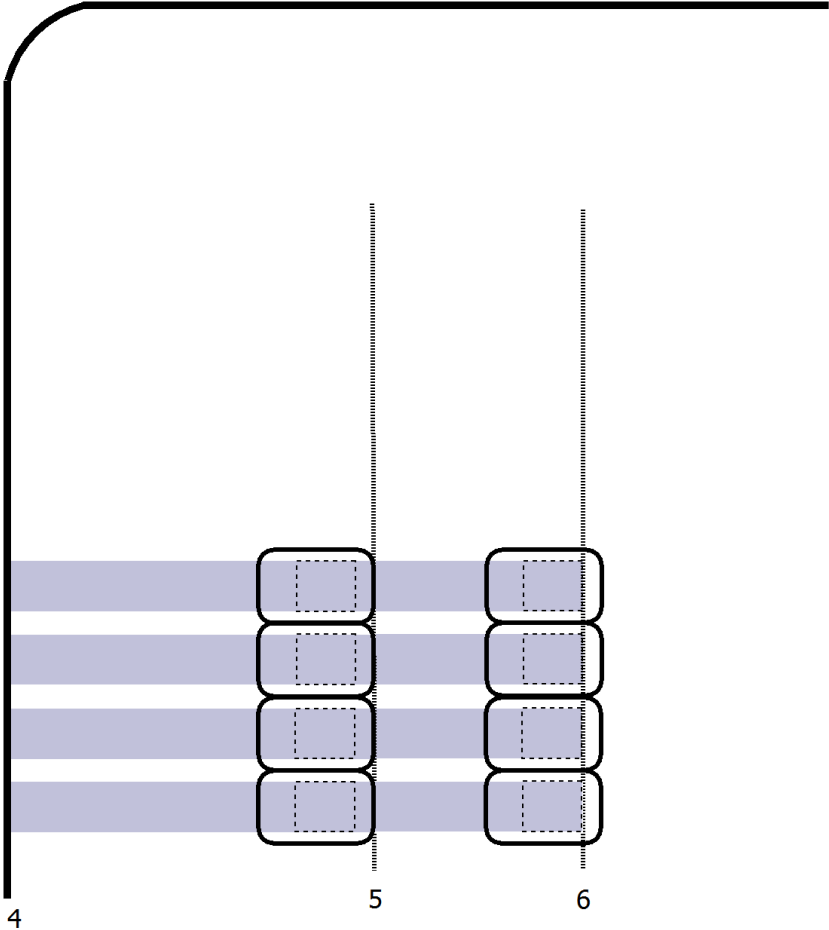
The upper and lower edge of all Rn coincide with the upper and lower edge of Cn.

Figure 5— Extent of Restricted Areas shows the horizontal extent of the Restricted Areas:

R1 to R4 extend horizontally from the left edge of the card (Line 4 in **Figure 5— Extent of Restricted Areas**) to the right edge of the corresponding physical contacts P1 to P4 (Line 5 in **Figure 5— Extent of Restricted Areas**).

R5 to R8 extend horizontally from the right edge of the physical contacts P1 to P4 (Line 5 in **Figure 5— Extent of Restricted Areas**) to the right edge of the minimum contact areas C5 to C8 (Line 6 in **Figure 5— Extent of Restricted Areas**).

Figure 5— Extent of Restricted Areas



7.2.6.2 #2509#: Design Rules for the Contact Layout

CQM Tag	#2509#		
CQM Requirement	7.2.6.2 #2509#: Design Rules for the Contact Layout		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM with a Contact Interface - Inlay with 7816-2 contacts - IACICM with a Contact Interface - Inlay with 7816-2 contacts - IAC having a Contact Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

- Each of the Physical Contacts P1, P2, P3, P5 and P7 shall fully cover its corresponding Minimum Contact Area. If present, the ICC Contact P6 shall fully cover the Minimum Contact Area C6.

ICM Requirements - Requirements applicable to the component ICM

Contact – applicable to ICM having a contact interface IC (“KICM”)

- Any conductive surface within a Restricted Area Rn shall only be galvanically connected to either its corresponding Minimum Contact Area Cn or to C5 (ground).
- If any part of the ICM extends into the distortion free area defined in ISO/IEC 7811-6, then the ICC vendor shall ensure, that the distortion free area defined in ISO/IEC 7811-6 remains indeed distortion free.

An ICM containing an IC that is fully robust against reverse polarization (V_{CC} at 0V while any combination of the other contacts are at maximum voltage without current limitation by the reader or test unit for time periods of at least 1 minute) is not required to comply with Rule 2.



Note

The contact layout shall comply with rule 1 as a result of requirement #2508#.



Note

The contact layout shall comply with rule 2 to avoid possible miscontacting of the contacts when the ICC is removed from a card reader while the card reader's contacts have not powered down. ICM containing IC robust against reverse polarization are not required to comply with this requirement.



Note

The contact layout shall comply with rule 3 to allow coexistence of the ICM with magnetic stripes and embossing on one card.

7.2.6.3 #2510#: Wire Bond Pull Strength

CQM Tag	#2510#		
CQM Requirement	7.2.6.3 #2510#: Wire Bond Pull Strength		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any ICM Activity - Inlay produced using an unpackaged IC - Any IAC/ICM Activity - iac/IL with at least one unpackaged IC - IAC produced using bare dice		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 20		
CQM Monitoring	1 item every Set-up.		

ICM Requirements - Requirements applicable to the component ICM

Contact – applicable to ICM having a contact interface IC (“KICM”)

The ICM vendor shall define minimum values for Wire Bond Pull Strength and control the process adequately so that, assuming normal distribution, 99.7% of the produced interconnections comply with the requirement¹².

The above Sample Size refers to the number of devices to be tested, not to the number of wires.

The following minimum values are recommended:

Wire Type	Minimum Wire Pull Strength [gram-force] Pre-seal ¹³	Minimum Wire Pull Strength [gram-force] Post seal or any other processing
18 µm Au	2.0	1.5
18 µm Al	1.5	1.0
20 µm Au	2.4	1.9
20 µm Al	1.9	1.2
25 µm Au	3.0	2.5
25 µm Al	2.5	1.5
32 µm Au	4.0	3.0
32 µm Al	3.0	2.0



Note

For wire diameters not in this table the nearest wire diameter shall be used.

An alternative table can be found in MIL883K Method 2011.7 and may be used alternatively to the above table.

In addition to the Wire Pull Strength the ICM vendor shall also monitor the failure mode (e.g. ball lift, wire break) and act accordingly to the occurrence of critical failure modes. Lift off of a bond from the IC or the substrate shall be considered a critical failure mode and shall result in corrective measures being taken by the vendor.

If the ICM vendor uses an interconnection technology different from wire bonding, e.g. flip chip, then the vendor shall develop an equivalent method to control the proper

¹² This may be assumed if the mean value of the pull test results minus 3 times the standard deviation is greater than the defined minimum value.

¹³ The “Pre-Seal” values are applicable to ICM that have completed wire bonding but have not been processed further. If the ICM have been processed further, e.g. encapsulated and then decapsulated, the values defined in the column “Post-seal” shall be used, as any processing after wire bonding is expected to reduce the Wire Bond Pull Strength.

ICM Requirements - Requirements applicable to the component ICM

Contact – applicable to ICM having a contact interface IC (“KICM”)

interconnection between the IC and the substrate, e.g. a die shear test to control the adhesion of bumps both to the IC and the substrate. A recommended minimum for such die shear test in case of flip-chip ICM is 5 gram-force per bond.



Note

IPC (www.ipc.org) has defined a test method containing useful information for ICM vendors conducting Wire Bond Pull Strength tests in IPC-TM-650. Another test method is defined in MIL-883G method 2011.7.



Note

Sampling of individual wires within a component containing wire bonded IC is not foreseen by CQM. The sampling rate applies to the number of devices that shall be tested, and all wires belonging to that device shall be tested. Cases have been observed in the past where a single systematically weak wire caused an app. 3% field failure rate per annum.

7.2.7 #2511#: Contact Assignment

CQM Tag	#2511#		
CQM Requirement	7.2.7 #2511#: Contact Assignment		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any ICM Activity - Inlay with 7816-2 contacts - IACICM with a Contact Interface - Inlay with 7816-2 contacts - IAC having a Contact Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 200		
CQM Monitoring	100% control required		

The Minimum Contact Areas defined in #2508# shall be connected to the corresponding IC Contacts. No Minimum Contact Areas shall be connected to any other contact of the IC.

Test Method: The Vendor shall define a method to test the IC is properly connected to the ICM contacts. The test method shall include a test for open connection, for short connection, and a functional test. For ICM with a contactless interface the test shall include the ICM contacts foreseen to connect to the antenna inside the ICC.

Table 7.1—Connection of Minimum Contact Locations to IC Contacts

Minimum Contact Area (see section R-P2-07)	IC Contact
C1	VCC
C2	RST
C3	CLK

Minimum Contact Area (see section R-P2-07)	IC Contact
C4	not connected
C5	GND
C6	not connected
C7	I/O
C8	not connected

7.3 Contactless – applicable to ICM having a contactless interface ("PICM")

7.3.1 #2512#: Electro Magnetic Behaviour

There are no requirements defined here regarding the electromagnetic behaviour of the ICM with respect to:

- Power switching
- Power consumption
- Minimum Field strength

In case the ICM is designed for an ICC with a contactless interface, the electromagnetic characteristics shall be tested at ICC level.

8 ICM Test methods – Test methods applicable to the component ICM

This chapter defines the Test Methods applicable to the component ICM, some of which are also applicable to IL, , and IAC..

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Note

Other test methods applicable to the ICM are defined in chapter 13 ID-1 Test Methods – Test Methods applicable to the components IL, CB, ICC, iacIL, and IAC. This is the case for test methods applicable to both the ICM and ID-1 shaped CHD, e.g. chemical exposure tests; and tests where the ICM can only be tested after it has been implemented into a card, e.g. 3 wheel test.

8.1 General – applicable to ICM independent of the interface ("ICM")

8.1.1 #8092#: Temperature and Humidity Exposure

CQM Tag	#8092#
CQM Test Method	8.1.1 #8092#: Temperature and Humidity Exposure

The compliance with the Requirement is determined by exposing the ICM to Temperature and Humidity (85 °C, 85% r.H.).

8.1.1.1 Temperature and Humidity Oven

The chamber used shall be capable of providing and controlling the following temperature and relative humidity when the chamber is loaded with the maximum load: +85 °C ± 2 °C; 85 % r.H. ± 3 % r.H.

The device holding the ICM during the Temperature and Humidity Exposure test shall have the following characteristics:

- The holder shall be designed to minimize obstruction of the airflow around the ICM under stress;
- Galvanic contact shall be made in the minimum contact areas as defined in ISO/IEC 7816-2.



Note

A chamber compliant with JESD 22-A101-B is compliant with the definition given herein. The climatic conditions defined here are the conditions within the oven's chamber. The resulting temperature of the devices under test is not defined here. As the recommended test includes static voltage bias to some of the contacts, it is recommended to use equipment that permits the application of voltage bias.

8.1.1.2 Procedure

The following sequence shall be applied:

1. Take the required number of samples
2. Inspect the ICM visually
3. Verify the ICM is fully functioning using an appropriate electrical test program
4. Place the ICM into the oven in such a position with respect to the air-stream that there is substantially no obstruction to the flow of air across and around the specimen.

5. Submit the ICM inside the oven to the conditions specified in the following table:

Condition	Value
Temperature	85 °C
Relative Humidity	85 % r.H
Duration	168 h
VCC	VCC \pm 10 %
RST	0 V \pm 0.4 V
GND, CLK	0 V \pm 0.4 V
I/O	High or Low bias
Current limitation	It is permitted to limit the current flowing through the VCC contact to 1 A or higher and the current flowing through any other contact biased to 'high' to 100 mA or more.

6. Inspect the ICM visually and note deviations to 1.

7. Verify the ICM is fully functioning using an appropriate electrical test program



Note

No condensation on the ICM inside the oven is permitted during the exposure.

For this version of the specification, this test may be conducted with the following modification:

- Same temperature and humidity conditions
- Duration: 500 h.
- All pins floating



Note

Exposing the ICM for 500 h without BIAS is likely to be removed from future versions of this document, except for purely contactless ICM. It is highly recommended for those still using the 500 h exposure test to switch to the 168 h exposure with BIAS test.

8.1.1.3 Test Report

The Test Report shall state deviations to the status of the ICM before the test determined by visual inspection including detailed pictures if deviations are noticed, and indicate if the ICM is fully functional before and after exposure.



Note

There is no Requirement forbidding changes of the visual aspect of the ICM as a result of above tests. Changes of the visual aspects are noted for information only. The fulfillment of the Requirement is mainly dependent on material selection and process parameters. Conclusively minor changes of the ICM design shall not be expected to change the result of this test. Changes of the ICM design providing a significant risk to change the outcome of this test are changes in material (e.g. encapsulation material, die-attach material, the PCB) and process changes affecting the surface of the components forming the ICM (e.g. surface treatment of the IC, the PCB) and process changes resulting in possible deposition of material on the components.

8.1.2 #8093#: Temperature Cycling

CQM Tag	#8093#
CQM Test Method	8.1.2 #8093#: Temperature Cycling

Compliance with the Requirement is determined by exposing the ICM to Temperature cycling (e.g. -40 °C to +85 °C, or equivalent).

8.1.2.1 Apparatus

Temperature Cycling oven air - air (2 chambers)

The chambers used shall at least be capable of providing and controlling the following temperatures when the chamber is loaded with the maximum load:

- Low temperature: between -35 °C and -55 °C with an accuracy of ± 5 °C
- High temperature: between 85 °C and 125 °C with an accuracy of ± 5 °C

The transfer time from hot to cold and cold to hot shall not exceed 1 minute.



Note

The climatic conditions defined here are the conditions within the oven's chamber. The resulting temperature of the devices under test is not defined here.

8.1.2.2 Procedure

The following sequence is applied:

1. Take the required number of samples
2. Inspect the ICM visually
3. Verify the ICM is fully functioning using an appropriate electrical test program
4. Place the ICM into the test oven in such a position with respect to the air-stream that there is substantially no obstruction to the flow of air across and around the specimen.
5. Expose the ICM to the conditions defined in the following table:

ICM Test methods – Test methods applicable to the component ICM
General – applicable to ICM independent of the interface (“ICM”)

Condition	Value
Tmin	–55 °C and –35 °C
Tmax	+85 °C and +125 °C
DeltaT (= Tmax – Tmin)	between 120 °C and 165 °C
Dwell time at Tmin	10 minutes or longer
Dwell time at Tmax	10 minutes or longer
Transfer time	Not more than 1 minute
Total cycle time (sum of the transfer time from low to high, the dwell time at Tmax, the transfer time from high to low and the dwell time at Tmin)	Not more than 30 minutes

for the number of cycles calculated in accordance with the Coffin-Manson relation with an exponent of 3.

The acceleration factor for the number of cycles can hence be calculated as follows:

$$AF = \left(\frac{\Delta T_{Test}}{\Delta T_{Use}} \right)^3$$

The number of cycles during the life of the card is the sum of power cycles due to use and environment induced cycles.

With 6 daily uses of the card and a typical 3-year lifetime, the temperature cycles due to use of the card alone sum up to slightly more than 6000. To simplify subsequent calculations, a total number of temperature cycles of 6000 is assumed.

A realistic temperature difference ΔT_{Use} on the surface of an IC between power off and power on states is 30 °C.

Hence the number of cycles under test conditions should be calculated as follows:

$$Cycles_{Test} = Cycles_{Use} \div \left(\frac{\Delta T_{Test}}{\Delta T_{Use}} \right)^3$$

The following values for the number of test cycles are calculated using the above formula:

Delta T [K]	Number of Cycles
120	95

ICM Test methods – Test methods applicable to the component ICM
General – applicable to ICM independent of the interface (“ICM”)

130	75
140	60
150	49
160	40
165	37

6. Remove the ICM from the oven, and conduct the subsequent checks within 72 h of removing the samples from the oven:
7. Inspect the ICM visually and note deviations to 1.
8. Verify the ICM is fully functioning using an appropriate electrical test program

Part E

Product Requirements and Test Methods for the CB, ICC, AIL and PIL Vendor

PART E CONTAINS THE FOLLOWING CHAPTERS:

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9 CB Requirements - Requirements applicable to the component CB

This chapter defines the Product Requirements applicable to the component CB, some of which are also applicable to ICC, and IAC.

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9.1 General - applicable to all CB independent of the interface

9.1.1 #3001#: CB, ICC, IAC - Construction and Specification

CQM Tag	#3001#		
CQM Requirement	9.1.1 #3001#: CB, ICC, IAC - Construction and Specification		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The card shall be produced by laminating multiple sheets (one of these might be an IL). Both sides of the card shall have an overlay.

The construction of the card shall be well defined and documented, including:

- All material layers and their type and thickness
- All printing layers, if any
- All adhesive layers, if any; this shall include adhesive coatings on e.g. overlays
- Any other layer, e.g. reflective metallic layers or IR blocking layers
- Type and location of surface add-ons such as holograms and signature panels
- Any antenna bearing layer, including location and geometry of the antenna
- In case of ICC or IAC , ICM or icIL or iacIL
- Manufacturing Processes
- Test Processes and Criteria (explicitly or by reference e.g. to a QC Plan)
- Qualification Criteria (explicitly or by reference e.g. to a Qualification Plan)

The vendor shall specify the construction of the card and document the specification. Examples for acceptable forms for a specification are written documents, tables listing requirements and product details, parts lists in ERP systems.

Test Method: no test method.

9.1.2 #3002#: Width and Height ^[IS7810]

CQM Tag	#3002#		
CQM Requirement	9.1.2 #3002#: Width and Height [IS7810]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card
Test Method	#8030#
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 8
CQM Monitoring	1 item every Set-up and card punch position.

Cards shall comply with the requirements defined in ISO/IEC 7810 section "Dimensions of card" for an unused ID-1 card.

Change or maintenance of a card punching tool shall trigger a re-qualification of the tool, verifying conformity with this requirement for each position of the punching tool.

Test Method: **#8030#**: *Width and Height* [IS10373-1]

9.1.3 #3003#: Thickness outside Contacts, Embossed Areas and Add-on Areas [IS7810]

CQM Tag	#3003#		
CQM Requirement	9.1.3 #3003#: Thickness outside Contacts, Embossed Areas and Add-on Areas [IS7810]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8040#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Batch.		

The thickness of the card outside the ICM area, embossed areas and Add-on Areas, including the area covered by the magnetic stripe, shall be at least 0.76 mm and never exceed 0.84 mm.



Note

This requirement also applies to the embossing area - as long as it is not embossed - and to the future contact area - as long as no ICM is embedded.



Note

Add-on Areas are areas of the card covered by signature panels, holograms etc.



Note

Areas of the CB or pICC containing, for example, antenna, ICs or ICM without contacts for contactless communications are not Add-on Areas.

Test Method:

#8040#: Card Thickness outside Contacts, Embossed Areas and Add-on Areas [IS10373-1]

9.1.4 #3004#: Thickness within Add-on Areas

CQM Tag	#3004#		
CQM Requirement	9.1.4 #3004#: Thickness within Add-on Areas		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8050#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

The difference between the thicknesses of the card inside any area covered by an Add-on (signature panel, hologram, etc. except embossing) and outside the area covered by the Add-On shall not exceed 0.05 mm.

If the size of a declared "Add-On" does not allow measuring the thickness outside of the Add-On area, the "Add-On" shall not be considered an Add-On but part of the regular card, and this requirement does not apply to this "Add-On" area. This is the case for example with protective varnishes and protective overlays covering the complete, or almost complete side of a card. In such case the card must comply with #3003# also in the area covered by the declared "Add-On".



Note

Add-On areas are any area on the surface of the card that is not part of the regular card body, and are restricted to a part of the card surface. This includes, but is not limited to, signature panels and holograms, and excludes embossed characters and ICM contacts. An added layer on the surface of the card covering the whole, or almost the whole surface of a card side is not an Add-On Area.

Test Method: **#8050#: Thickness within Add-on Areas** [IS10373-1]

9.1.5 #3005#: Corners [IS7810]

CQM Tag	#3005#		
CQM Requirement	9.1.5 #3005#: Corners [IS7810]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8060#		
Default CQM Q-Plan:			

CB Requirements - Requirements applicable to the component CB

General - applicable to all CB independent of the interface

CQM Qualification	Minimum Sample Size: 8
CQM Monitoring	1 item every Year and card punch position.

The corners of the CB or pICC shall be rounded with a radius of 3.18 mm \pm 0.3 mm. The corners shall be aligned with the straight edges of the CB.

Change or maintenance of card punching tools shall trigger a re-qualification of the tool, verifying conformity with this requirement for each position of the punching tool.

Test Method: **#8060#: Corners** [IS10373-1]

9.1.6 #3006#: Card Edges [IS7810]

CQM Tag	#3006#		
CQM Requirement	9.1.6 #3006#: Card Edges [IS7810]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8070#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 20		
CQM Monitoring	1 item every Set-up and card punch position, recheck required each 10000 items produced.		

The edges of the card shall be free of edge-burrs, notches and other imperfections.

This requirement also applies to cards as they might result from processes changing the edges after punching.



Note

The sample sizes relate to identical processes. If multiple similar processes are used in parallel, then each of these similar processes shall be checked using the defined sample sizes, e.g. if a punching tool with 3 positions is used in a card punch, then each of these 3 punch positions shall be qualified and monitored using the defined sample sizes per position.



Note

The term 'notches' in this case identifies irregularities of the cards edge, not features intended for allowing identification of the card or its orientation.



Note

In case of doubt, if edge burrs are detected using the test method #8070#, the difference in height between any part of the CB's/pICC's edges and the adjacent surface shall be measured and shall not exceed 0.08 mm.

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

Test Method: **#8070#: Card Edges** *[IS10373-1]*

9.1.7 #3007#: Overall Card Warpage *[IS7810]*

CQM Tag	#3007#		
CQM Requirement	9.1.7 #3007#: Overall Card Warpage [IS7810]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	#8100#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Batch.		

The maximum distance from a flat rigid plate to any portion of the card placed on that plate shall not exceed 1.5 mm including the card's thickness.

Test Method: **#8100#: Overall Card Warpage** *[IS10373-1]*

9.1.8 #3008#: Opacity of cards with an opaque core *[IS7810]*

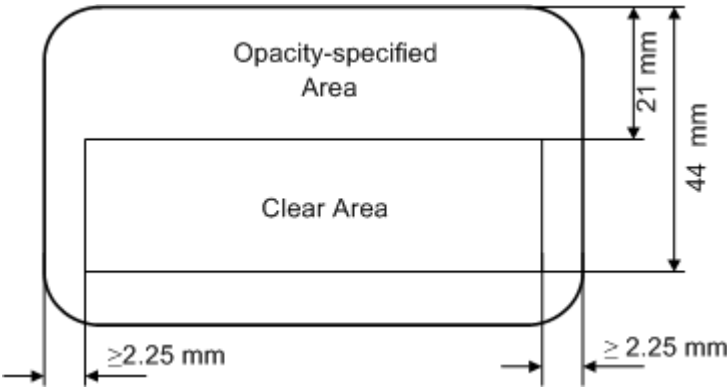
CQM Tag	#3008#		
CQM Requirement	9.1.8 #3008#: Opacity of cards with an opaque core [IS7810]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8200#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

A card is a 'card with an opaque core' if the core layers on their own, without overlay, printing and add-ons, pass this requirement.

The opacity of the card shall comply with the requirement "Opacity" defined in ISO/IEC 7810.

There is no requirement about opacity applying to the clear area as defined below:

Figure 6—Card Opacity Area



Test Method: [#8200#](#): *Opacity*



Note

After changing the core material of the card, for example changing from white to black PVC, the Vendor needs to re-qualify conformity with this requirement.

9.1.9 [#3065#](#): Opacity of cards with a translucent or transparent core ^[IS7810]

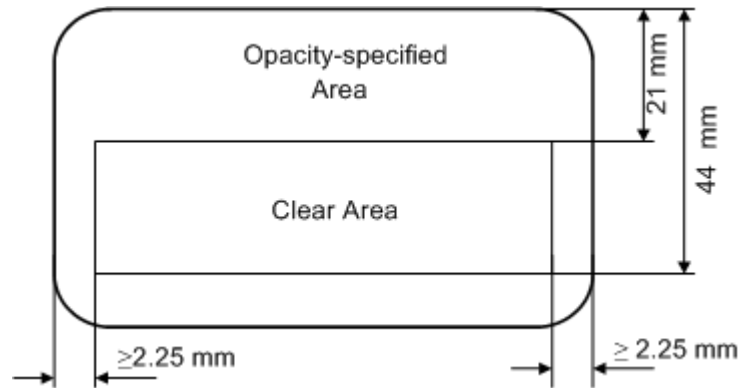
CQM Tag	#3065#		
CQM Requirement	9.1.9 #3065#: Opacity of cards with a translucent or transparent core [IS7810]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8200#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Batch.		
Changelog:			
After V2.19.1	Editorial changes only: adjusted to recent edition of 7810		

A card is a 'card with a translucent or transparent core' if the core plastic layers on their own (without print, IR blockers, etc.) do not comply with requirement [#3008#](#): *Opacity of cards with an opaque core* [IS7810].

The opacity of the card shall comply with the requirement "Opacity" defined in ISO/IEC 7810.

There is no requirement about opacity applying to the clear area as defined below:

Figure 7—Card Opacity Area



Test Method: **#8200#**: Opacity

9.1.10 #3009#: Magnetic Stripe – Application Technology

CQM Tag	#3009#		
CQM Requirement	9.1.10 #3009#: Magnetic Stripe – Application Technology		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<ul style="list-style-type: none"> - Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card 		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The magnetic stripe shall be laminated. A hot stamped, slurry and or roll-on magnetic stripe is not permitted.

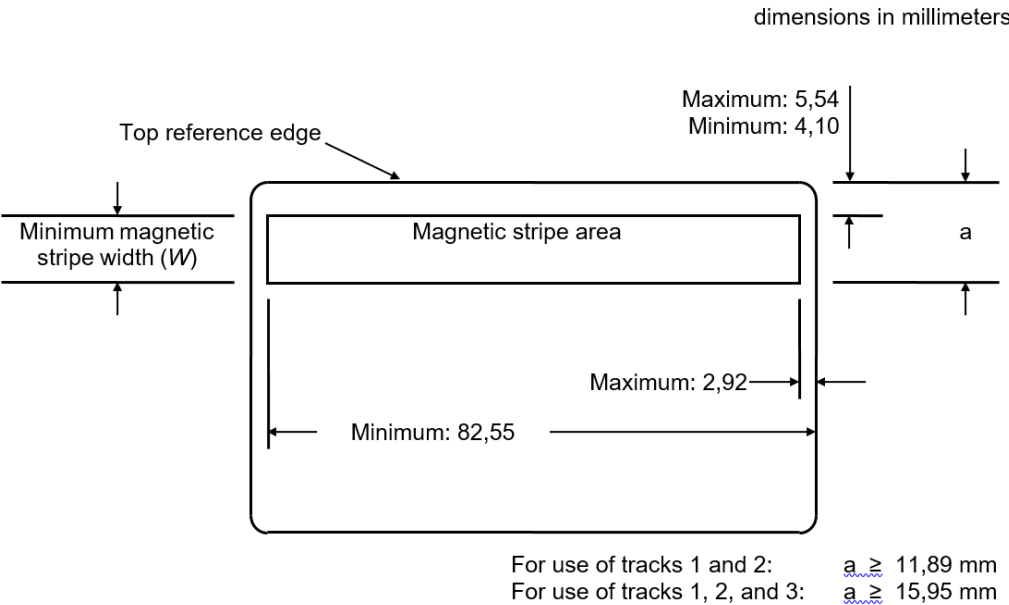
9.1.11 #3010#: Magnetic Stripe – Location of Magnetic Stripe ^[ISO7811-6]

CQM Tag	#3010#		
CQM Requirement	9.1.11 #3010#: Magnetic Stripe – Location of Magnetic Stripe [ISO7811-6]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<ul style="list-style-type: none"> - Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card 		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 50		
CQM Monitoring	1 item every Batch and card punch position.		

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

By default, the magnetic material shall completely cover at least the area enclosed by the four lines shown in **Figure 8** :

Figure 8—Location of Magnetic Stripe



- For three track magnetic stripes, two lines parallel to the X-AxisReference at a distance of 5.54 mm and 15.95 mm to the top reference edge,
- For two track magnetic stripes, two lines parallel to the X-AxisReference at a distance of 5.54 mm and 11.89 mm to the top reference edge,
- Two lines parallel to the Y-AxisReference at a distance of 2.92 mm and 82.55 mm to the left reference edge, (It is recommended to have the magnetic stripe cover the complete area from the Left Y-edge to the Right Y-edge of the CB) on the back side of the CB.

The magnetic stripe and the ICM shall not overlap. It is recommended to maintain a distance of at least 1 mm between these 2 elements.

Test Method: No method is defined here. The Vendor shall use adequate measurement tools, e.g. XY measurement table or a calibrated template to check conformity with this requirement.

9.1.12 #3011#: Magnetic Stripe – Magnetic Stripe Area Warpage [ISO7811-6]

CQM Tag	#3011#	
CQM Requirement	9.1.12 #3011#: Magnetic Stripe – Magnetic Stripe Area Warpage [ISO7811-6]	
Applicable to Entity	Vendor	Subcontractor

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	IS10373-2		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

The magnetic stripe area shall comply with the requirement "Magnetic stripe area warpage" of ISO/IEC 7811-6.

Test method: Conformity shall be determined using the corresponding test method from ISO/IEC 10373-2.

9.1.13 #3012#: Magnetic Stripe – Magnetic Stripe Surface Distortions [ISO7811-6]

CQM Tag	#3012#		
CQM Requirement	9.1.13 #3012#: Magnetic Stripe – Magnetic Stripe Surface Distortions [ISO7811-6]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Batch and card punch position.		

The CB shall comply with the requirement "Surface distortions" of ISO/IEC 7811-6.

Test method: The Vendor shall use adequate visual inspections to ensure CBs are free of surface distortions on a sampling basis. Such inspections typically include visual checks after lamination and/or punch.

9.1.14 #3013#: Magnetic Stripe – Magnetic Stripe Surface Roughness [ISO7811-6]

CQM Tag	#3013#		
CQM Requirement	9.1.14 #3013#: Magnetic Stripe – Magnetic Stripe Surface Roughness [ISO7811-6]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	IS10373-2		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

The Card shall comply with the requirement "Magnetic stripe surface roughness" from ISO/IEC 7811-6.

Test method: Conformity shall be determined using the corresponding test method from ISO/IEC 10373-2.

Changes to influential factors like magnetic stripe type or lamination plate roughness shall be subject to requalification of conformity to this requirement.

The vendor is permitted to produce and supply cards with a Magnetic stripe surface with an average surface roughness (R_a) of up to 0.70 μm , provided the vendor verifies conformity with #3025# for every CB batch, and has received written agreement from the personalizer authorizing the shipment of such cards to the personalizer.

9.1.15 #3014#: Height and Surface Profile of the Magnetic Stripe [ISO7811-6]

CQM Tag	#3014#		
CQM Requirement	9.1.15 #3014#: Height and Surface Profile of the Magnetic Stripe [ISO7811-6]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any InterActive Card		
Test Method	IS10373-2		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 5		
CQM Monitoring	5 items every Year.		

The magnetic stripe area shall comply with the requirement "Height and Surface Profile of the Magnetic Stripe Area" of ISO/IEC 7811-6.

Test method: Conformity shall be determined using the corresponding test method from ISO/IEC 10373-2.

9.1.16 #3022#: Magnetic Stripe – Adhesion of Stripe to Card [ISO7811-6]

CQM Tag	#3022#		
CQM Requirement	9.1.16 #3022#: Magnetic Stripe – Adhesion of Stripe to Card [ISO7811-6]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	IS10373-2		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

The magnetic stripe shall not separate from the card under normal use.

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

Test Method: See ISO/IEC 10373-2 "Magnetic Stripe Adhesion".

9.1.17 #3024#: Magnetic Stripe – Wear from Read/Write Head [ISO7811-6]

CQM Tag	#3024#		
CQM Requirement	9.1.17 #3024#: Magnetic Stripe – Wear from Read/Write Head [ISO7811-6]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	IS10373-2		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

After 4000 head wear cycles, the average signal amplitude (UA) and individual signal amplitude (Ui) shall verify:

- $UA_{after} \geq 0.60 UA_{before}$, and
- $Ui_{after} \geq 0.80 UA_{after}$.

There is no requirement defined here with respect to the visual aspect of a normal magnetic stripe after the wear cycles.

Any decorative addition to the surface of the magnetic stripe, such as holographic layers or printed logos shall remain visible and recognizable according to the applicable requirements, including those in #7120#: Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) - Adhesion, Aspect and Shape, Size and Positioning after exposure to abrasion and wear tests.

9.1.18 #3025#: Magnetic Stripe – Dynamic Characteristics of a High Coercivity Magnetic Stripe [ISO7811-6]

CQM Tag	#3025#		
CQM Requirement	9.1.18 #3025#: Magnetic Stripe – Dynamic Characteristics of a High Coercivity Magnetic Stripe [ISO7811-6]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	IS10373-2		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 3		
CQM Monitoring	1 item every Magnetic Stripe Batch, or Supplier CoC.		
Changelog:			

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

After V2.19.1	Technical changes (incl. editorial changes): Now only requires compliance with 7811-6
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A High Coercivity Magnetic Stripe on a CB, ICC, or IAC shall comply with ISO/IEC 7811-6

9.1.19 #3015#: Solidity – Peel Strength of the Overlay ^[IS7810]

CQM Tag	#3015#		
CQM Requirement	9.1.19 #3015#: Solidity – Peel Strength of the Overlay [IS7810]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8240#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Batch.		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): Added concept of Critical Test Strips to reduce effort during monitoring		

The force necessary to separate any layer covering a printed surface of the card ("Overlay") from the rest of the card shall be at least 5.0 N/cm in the area up to 5 mm from the edge of the card, and at least 3.5 N/cm for areas more than 5 mm from the edges of the card.

This requirement applies explicitly to cards with the final artwork. Peel strength results obtained with blank white cards are not representative for peel strength results obtained using printed cards.

Where the test method **#8240# Advanced Peel Strength Test** requires testing multiple test sections, the Vendor may apply the following method to determine which test sections are Critical Test Sections to reduce the number of test sections to be tested during monitoring:

- The vendor shall measure all the test sections required by the test method during qualification of the artwork, in both directions
- The vendor shall retain the measurement records, including the peel force record, and which test section and direction each measurement relates to
- The vendor shall identify the Critical Test Sections. Critical Test Sections are test sections that show peel force values in the area up to 5 mm from the edge of the card, that are less than 150% of the required minimum for that area. If none of the test sections shows force values that low, then the vendor shall consider the test section with the lowest peel force in the area less than 5 mm from the card edge a Critical Test Section.



Note

Example for determining the Critical Test sections:

Scenario 1: #8240# determines the Vendor shall test the test strips H1, H2, H3, H4. During qualification the vendor determines the peel strength in the areas less up to 5 mm from the edge of the card to be 6 N/cm for H1, 10 N/cm for H2, 7 N/cm for H3, and 12 N/cm for H4. The minimum peel strength required for this area is 5 N, and 150% of that are 7.5 N. Critical Test Sections for Scenario 1: Critical Test Sections are H1 and H3, because both show values below 7.5 N/cm.

Scenario 2: #8240# determines the Vendor shall test the test strips H1, H2, H3, H4. During qualification the vendor determines the peel strength in the areas less up to 5 mm from the edge of the card to be 8 N/cm for H1, 10 N/cm for H2, 9 N/cm for H3, and 12 N/cm for H4. The minimum peel strength required for this area is 5 N, and 150% of that are 7.5 N. Critical Test Sections for Scenario 2: Critical Test Section is H1 and H3, because none of the test sections shows a value below 7.5 N/cm, and Test Section H1 shows the lowest peel strength value in the area up to 5 mm from the edge of the card.

- The vendor shall document which test section are determined to be Critical Test Sections, and in which peel direction they are found to be critical, for a specific artwork.

If the vendor has determined the Critical Test Sections for a specific artwork, then the vendor is permitted to only test the Critical Test Sections determined for a specific artwork during monitoring.



Note

The sample size in this requirement refers to the number of measurements required. Depending on the method chosen, and the specific configuration of the card, multiple cards may be required to achieve the required number of measurements.

Test Method: **#8240# Advanced Peel Strength Test**

9.1.20#3016#: Solidity – Peel Strength between Core Layers ^[IS7810]

CQM Tag	#3016#		
CQM Requirement	9.1.20 #3016#: Solidity – Peel Strength between Core Layers [IS7810]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8240#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Year.		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): Added concept of Critical Test Strips to reduce effort during monitoring		

Core Layers are all Layers of the card except the Overlay.

Core Layers shall have a minimum peel strength of 5 N/cm in the area up to 3 mm from the edge of the card, and a minimum peel strength of 3.5 N/cm for areas more than 3 mm from the edge of the card.

Areas with a lower peel strength than 3.5 N/cm between core layers are permitted in the zone further than 3 mm from the edge of the card. The length of these areas with a lower peel strength shall not exceed 10 mm, and the adhesion in these areas shall never be less than 2 N/cm.

Where the test method **#8240# Advanced Peel Strength Test** requires testing multiple test sections, the Vendor may apply the following method to determine which test sections are Critical Test Sections to reduce the number of test sections to be tested during monitoring:

- The vendor shall measure all the test sections required by the test method during qualification of the artwork, in both directions
- The vendor shall retain the measurement records, including the peel force record, and which test section and direction each measurement relates to
- The vendor shall identify the Critical Test Sections. Critical Test Sections are test sections that show peel force values in the area up to 5 mm from the edge of the card, that are less than 150% of the required minimum for that area. If none of the test sections shows force values that low, then the vendor shall consider the test section with the lowest peel force in the area less than 5 mm from the card edge a Critical Test Section.



Note

Example for determining the Critical Test sections:

Scenario 1: #8240# determines the Vendor shall test the test strips H1, H2, H3, H4. During qualification the vendor determines the peel strength in the areas less up to 5 mm from the edge of the card to be 6 N/cm for H1, 10 N/cm for H2, 7 N/cm for H3, and 12 N/cm for H4. The minimum peel strength required for this area is 5 N, and 150% of that are 7.5 N. Critical Test Sections for Scenario 1: Critical Test Sections are H1 and H3, because both show values below 7.5 N/cm.

Scenario 2: #8240# determines the Vendor shall test the test strips H1, H2, H3, H4. During qualification the vendor determines the peel strength in the areas less up to 5 mm from the edge of the card to be 8 N/cm for H1, 10 N/cm for H2, 9 N/cm for H3, and 12 N/cm for H4. The minimum peel strength required for this area is 5 N, and 150% of that are 7.5 N. Critical Test Sections for Scenario 2: Critical Test Section is H1 and H3, because none of the test sections shows a value below 7.5 N/cm, and Test Section H1 shows the lowest peel strength value in the area up to 5 mm from the edge of the card.

- The vendor shall document which test section are determined to be Critical Test Sections, and in which peel direction they are found to be critical, for a specific artwork.

CB Requirements - Requirements applicable to the component CB

General - applicable to all CB independent of the interface

If the vendor has determined the Critical Test Sections for a specific card construction, then the vendor is permitted to only test during monitoring the Critical Test Sections determined for a specific card construction.



Note

The sample size in this requirement refers to the number of measurements required. Depending on the method chosen, and the specific configuration of the card, multiple cards may be required to achieve the required number of measurements.

Test Method: **#8240# Advanced Peel Strength Test**

9.1.21 #3017#: Solidity – Peel Strength of the Overlay after Temperature and Humidity Exposure

CQM Tag	#3017#		
CQM Requirement	9.1.21 #3017#: Solidity – Peel Strength of the Overlay after Temperature and Humidity Exposure		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8092# #8240#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Year.		

The force necessary to separate any layer covering a printed surface of the card from the rest of the card after exposure to temperature and humidity (50 °C and 93% r. H. for 168 h) shall be at least 80 % of the peel strength value obtained when checking conformity to **#3015#: Solidity – Peel Strength of the Overlay** ^[IS7810], or 5 N/cm, whichever is less.

This requirement applies explicitly to cards with the final artwork; peel strength results obtained with blank white cards are not representative for the peel strength of printed cards.



Note

The sample size in this requirement refers to the number of measurements required. Depending on the method chosen, and the specific configuration of the card, multiple cards may be required to achieve the required number of measurements.

Test Method: **#8092#: Exposure to Temperature and Humidity** ^[IS24789-2]

9.1.22 #3018#: Solidity – Resistance to Corner Impact

CQM Tag	#3018#
CQM Requirement	9.1.22 #3018#: Solidity – Resistance to Corner Impact

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- CB containing an inlay (but no IC) - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8170#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	2 items every Batch.		

The laminated card shall resist delamination of the overlay when exposed to a corner impact as defined in the test method.

The laminated card should resist delamination between core layers when exposed to a corner impact as defined in the test method.

If core layers show delamination during the Corner Impact test, then the peel strength between the Core Layers showing delamination as a result of the corner impact test shall be verified before deciding conformity with this requirement:

- with a sample size of 5 cards, and
- using test method **#8240# Advanced Peel Strength Test**,
- testing the horizontal and vertical test strips adjacent to the corner(s) showing delamination, e. g. test strips H4 and V7 if the lower right corner shows delamination, and
- peeling towards the edges forming the corner(s) showing delamination.

If, following a corner impact test showing delamination between core layers, the peel strength test results required above, of the test strips adjacent to the corner(s) showing delamination, exceed the minimum requirement defined in **#3016#: Solidity – Peel Strength between Core Layers** ^[IS7810], and the card shows no delamination of the overlays during the corner impact test, then the card shall be considered compliant with this requirement, even if the card did show delamination between core layers as a result of exposure to **#8170#: Corner Impact Test** ^[ANSI NCITS 322 5.20].

Test Method: **#8170#: Corner Impact Test** ^[ANSI NCITS 322 5.20]

9.1.23 #3019#: Solidity – Resistance to Impact

CQM Tag	#3019#		
CQM Requirement	9.1.23 #3019#: Solidity – Resistance to Impact		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC		
Test Method	#8160#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 3		
CQM Monitoring	1 item every Year.		

CB Requirements - Requirements applicable to the component CB

General - applicable to all CB independent of the interface



Note

This requirement helps identifying certain problems with card materials or caused by the lamination process that may result in cracking of the card during embossing or other forms of mechanical personalization, or causing mechanical failure prematurely during the card's life. Passing this test is not sufficient to ensure that a card can be properly embossed.



Note

If a card is specified to be not suitable for mechanical stressful personalization such as embossing or indent, but solely for personalization methods like laser engraving, thermal transfer, retransfer or dye-sublimation, ink jet, or another additive printing method, then the product is not required to conform to this requirement.

The CB or ICC shall not splinter or show any cracks through the material after being submitted to a defined impact moment E of 2 Nm using the test method: #8160#: Impact Resistance [ISO7811-1].

The CB or ICC shall not splinter nor shall any parts of the card be broken off after being submitted to a defined impact moment E of 10 Nm using the test method: #8160#: Impact Resistance [ISO7811-1].

E = drop height x impact weight; the weight of the impact weight is defined in the test method as 18N.

An alternative to this test is the embossing of cards and verification of conformity with **#4026#: Absence of Residual Stress**.



Note

The CB will show significant deformation in the area hit by the weight. This is not a non-conformity.

Test Method: **#8160#: Impact Resistance** [ISO7811-1]

9.1.24 #3020#: Solidity – Resistance to Surface Abrasion

CQM Tag	#3020#		
CQM Requirement	9.1.24 #3020#: Solidity – Resistance to Surface Abrasion		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#9040#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Year.		

The card design shall remain visible and all printed information legible, and the printed security elements shall remain fully functional after the following number of abrasion

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

cycles in accordance with test method #9040#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand:

Method ID	Method Name	Number of cycles
#9041#	Sandpaper Rub Test	10
#9042#	Soft Eraser Rub Test	20
#9043#	Tape Pull Test	5



Note

The card shall be assumed compliant if it has an overlay on each side with a thickness of at least 30 µm.

Test Method: **#9040#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand**

9.1.25 #3021#: Solidity – Adhesion or Blocking ^[IS7810]

CQM Tag	#3021#		
CQM Requirement	9.1.25 #3021#: Solidity – Adhesion or Blocking [IS7810]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#8130#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 5		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Editorial changes only: References 7810, minor editorial		

ID-1 sized CHD shall comply with the requirement ISO/IEC 7810 section "Adhesion or blocking".

This requirement also applies to ICC, IAC, and personalized cards, if at least 10% of the surface is printed using dye sublimation/retransfer, or similar technologies that might change the conformity with the requirement.

Cards that are only graphically personalized using embossing, indent, laser, ink-jet, or thermal transfer technologies may be assumed compliant and are not required to be tested for compliance. Cards that are graphically personalized using re-transfer methods, or where the graphical personalization is subsequently covered by an overlay, shall be tested for conformity to this requirement.

Independent of the personalization technology, cards are also not required to be tested for compliance if the cards are mailed out by the personalizer singularly, e.g. on a card carrier form.

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

Cards mailed out by the personalizer in a stacked format, e.g. multiple cards together in a box shipped to a branch, must be checked for conformity if an applicable graphical personalization technology was used.

Test Method: **#8130#**: *Adhesion or Blocking [IS10373-1]*

9.1.26 #3027#: Layout and Printing – Printing according to Card Design Standards

CQM Tag	#3027#		
CQM Requirement	9.1.26 #3027#: Layout and Printing – Printing according to Card Design Standards		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any Personalisation activity - Any InterActive Card		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Batch.		

The Card Vendor shall ensure through adequate definitions, test methods and controls that the Card is printed according to the applicable Card Design Standards.

The Card Vendor shall ensure that any Mastercard brandmark is reproduced according to the current version of the Card Design Standards, unless the use of a previous version is explicitly permitted by the issuer in writing, after the Vendor has informed the issuer that the requested version of the brandmark is outdated.

9.1.27 #3028#: Layout and Printing – Color Reference System and Printed Color Tolerance

CQM Tag	#3028#		
CQM Requirement	9.1.27 #3028#: Layout and Printing – Color Reference System and Printed Color Tolerance		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any Personalisation activity - Any InterActive Card		
Test Method	#7010#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Batch.		

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

The Colors of the Mastercard Brand Marks are defined based on the Pantone® Reference System as specified in the respective Card Design Standards and replicated in the table below. Also provided in the table below are L*a*b values corresponding to each of the Pantone References, based on standard illuminant D50/2 and Measuring Mode M2:

PMS Reference	Name	L	a	B
1375 C	Mastercard Yellow	75.28	34.26	75.94
165 C	Mastercard Orange	64.76	58.52	67.92
2035 C	Mastercard Red Maestro Red	46.96	73.74	52.7
272 C	Maestro Purple	51.48	14.96	-40.7
299 C	Maestro Blue Cirrus Light Blue	60.98	-24.33	-44.17
2172 C	Cirrus Medium Blue	49.31	-3.26	-53.92
2144 C	Cirrus Dark Blue	41.46	-2.49	-53.14

The card manufacturer shall ensure that reproduction of the above colors in the finished card is within acceptable tolerances.

Standard Tolerances are defined using ΔE^*_{ab} CIEDE2000. Two tolerance limits are defined for the Standard Tolerances:

Standard Limits	ΔE^*_{ab} CIEDE2000
Standard Acceptance Limit	4.0
Standard Waiver Limit	7.0

Expanded Tolerances are defined using ΔE^*_{ab} CIEDE2000 for the following card constructions:

- Card constructions where the printed layer or the overlay are made from at least 70% recycled material
- Transparent and translucent card constructions
- The printed layer is not made of white plastic material, but of a colored plastic material, like red, green, or black plastic material

Two tolerance limits are defined for the Expanded Tolerances:

Expanded Limits	ΔE^*_{ab} CIEDE2000
Expanded Acceptance Limit	7.0
Expanded Waiver Limit	9.0

The Acceptance Limit is the maximum permitted deviation of the reproduced color from the reference color, expressed as ΔE^*_{ab} CIEDE2000.

If the measured color does not deviate more than the Acceptance Limit from the PMS Reference, then the reproduced color is acceptable, and no corrective actions with respect to future print runs are required.

The Waiver Limit is the maximum temporarily permitted deviation of the reproduced color from the reference color, expressed as ΔE^*_{ab} CIEDE2000.

If the measured color does not deviate more than the Waiver Limit, but more than the Acceptance limit, from the PMS Reference, then the reproduced color is acceptable for the already printed batch, but the vendor shall take corrective actions to bring the color deviation below the Acceptance Limit for future print runs.

If the measured color does deviate more than the Waiver Limit from the specified PMS Reference, then the reproduced color is not acceptable, and the cards shall not be delivered.

The vendor shall verify each logo color after lamination and not only after printing, because the influence of the overlay (or varnish), temperature, and other effects may change the appearance of the printed color.

As the actual areas covered by the logo colors may be too small for an accurate color measurement, the vendor shall print at least one dedicated measurement area for each of the three logo colors onto the printed sheet, outside of the areas foreseen for the printed cards.

It is highly recommended, that the vendor "fingerprints" the influence the overlay (or varnish) and the lamination process may have on the printed colors and adjusts the print colors accordingly, because the influence of an overlay can be in the range of the Acceptance Limit and thus make it difficult to produce cards of acceptable quality, if not compensated for.

If the vendor has fingerprinted the overlay and other potential factors, and can demonstrate that the printed color has been adjusted to compensate, then the vendor is permitted to control the printed logo colors right after printing and is not required to control the printed logo colors after lamination, provided the vendor keeps these factors potentially influencing the appearance of the printed color such as the overlay and the lamination parameters unchanged.

9.1.28#3030#: Layout and Printing – Metallic Colors conforming with Card Design Standards

CQM Tag	#3030#		
CQM Requirement	9.1.28 #3030#: Layout and Printing – Metallic Colors conforming with Card Design Standards		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

Applicable to CQM Products	
Test Method	
Default CQM Q-Plan:	
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.
CQM Monitoring	None required
Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): removed

9.1.29 #3031#: Layout and Printing – Printing Registration

CQM Tag	#3031#		
CQM Requirement	9.1.29 #3031#: Layout and Printing – Printing Registration		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#7030#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Batch.		
Changelog:			
After V2.19.1	Editorial changes only: chanaeloa corrected		

Registration defines a set of rules and tolerances related to the size of printing elements, as well as their positioning against card edge or against any other printed element on the same card side or on the reverse side.

9.1.29.1 Face/Reverse:

The relative positioning tolerance of the front of the card to the rear of the card shall not exceed ± 0.5 mm.



Note

This is typically measured as a process control through printed reference markings on printed sheets after lamination and not on the artwork of the finished card.

9.1.29.2 Trapping:

When two elements in two different colors are printed adjacent to each other in different printing processes, positioning tolerances can result in one of these elements being printed at some distance to the other, resulting in the background color, often the white core material, showing as a thin strip between the two elements. This can significantly distort the artwork. To avoid this, one or both of these printed elements are increased in size and printed such that one always slightly overlaps the other, so that if one is printed in a slightly different position, the background does not show through between them. This technique is referred to here as "trapping".

Trapping, if employed, shall be achieved without affecting the size, positioning and shape of the printed elements as defined in [CDS]. It shall not be visible under normal daylight when observed by a normal sighted person at a distance of 40 cm with an observation time of less than two seconds.

9.1.29.3 Reverse Trapping:

"Reverse Trapping" is the showing of a background color, often that of the core material, between two printed elements intended to be adjacent to each other in the artwork. This can happen when these two printed elements are printed in different printing processes or print runs.

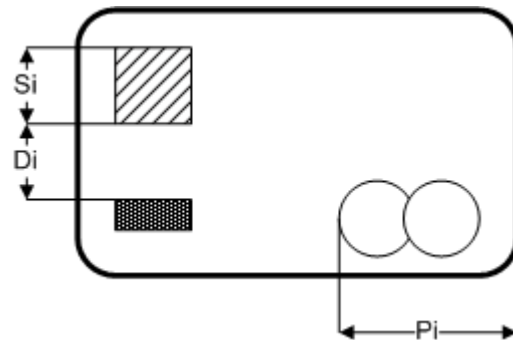
Reverse trapping is not permitted.

9.1.29.4 Positioning:

Three types of positioning parameters X shall be checked (see [Figure 9](#)).

- $X = P$ = positioning of an element against a card edge.
- $X = D$ = positioning of one element versus another element.
- $X = S$ = size of an element.

Figure 9: Positioning Parameters



9.1.29.4.1 Definition:

X_{io} = nominal value for the positioning parameter X of element i specified in [CDS]

X_{ic} = current measured value for the positioning parameter X of element i

$$\Delta X = |X_{io} - X_{ic}|$$

9.1.29.4.2 Parameter Limits:

All positioning parameters X and tolerances t mentioned in [CDS].

9.1.29.4.3 Positioning of elements against card edges (on finished cards, being the result of the whole card manufacturing process)

P_{ic} shall be such that $\Delta P < t_p$.

t_p shall be 0.5 mm.

9.1.29.4.4 Relative Positioning of the elements (distance between two elements)

D_{ic} shall be such that $\Delta D < t_d$.

t_d shall be 0.1 mm for all printing methods except screen print, 0.2 mm for screen printed elements in one color against each other, and 0.4 mm for screen printed elements against other printed elements on the card.

9.1.29.4.5 Size of printed element

S_{ic} shall be such that $\Delta S < t_s$.

t_s shall be 0.1 mm.

9.1.29.4.6 Cumulation of tolerances

All tolerances above may be cumulated. $t_p + t_d + t_s$ is acceptable as a final tolerance for any element measured against the card edges.

9.1.30 #3032#: Layout and Printing – Printing Defects

CQM Tag	#3032#		
CQM Requirement	9.1.30 #3032#: Layout and Printing – Printing Defects		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#7040#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Batch, recheck required each 100 items produced.		

A printing defect is any visible deviation from the originally intended graphic image.

Cards shall be inspected for printing defects (e.g. density irregularities, definition, dot spread, spotting, hickey, absence of ink, emulsification, moiré, ink rub) under normal daylight and at a distance of 40 cm by a normal sighted observer for a time of approximately 2 s. Cards with defects visible under these conditions shall not be supplied.

9.1.30.1 Printing Defects Classification

When the Vendor classifies deviations of the Printing Aspect, the following classifications should be considered:

- Defects affecting a security element in such a way that this element may be considered as counterfeit or can no longer be judged as genuine
- Defect affecting the branding
- Defect affecting other parts of the artwork.

Defects affecting a security element shall receive the highest priority, followed by defects affecting the appearance of Mastercard branding.



Note

The size and frequency of the printing defects may change the perception of the defect.

9.1.31#3033#: Layout and Printing – Card Assembly Defects

CQM Tag	#3033#		
CQM Requirement	9.1.31 #3033#: Layout and Printing – Card Assembly Defects		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#7050#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Batch. recheck required each 1000 items produced.		

Cards shall be inspected for card assembly defects (e.g. scratches, laminating flashes, dust or any other visual defect resulting from the manufacturing processes following printing) under normal daylight and at a distance of 40 cm by a normal sighted observer for a time of approximately 2 s. Cards with card assembly defects visible under these conditions shall not be supplied.

9.1.31.1 Card Assembly Defects Classification

When the Vendor classifies Card Assembly Defects, the following classifications should be considered:

- Defects affecting the card functionality, (like: scratches to the magnetic stripe).
- Defects affecting a security element in such a way that this element may be considered as counterfeit or resulting from fraudulent production, potentially resulting in acceptance problems.
- Defects affecting the Mastercard branding.

- Defects affecting the other aspects of the card.

9.1.32 #3034#: Layout and Printing – UV Printing

CQM Tag	#3034#		
CQM Requirement	9.1.32 #3034#: Layout and Printing – UV Printing		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#7100#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Batch, recheck required each 10000 items produced.		
Changelog:			
After V2.19.1	Editorial changes only: clarified that MC no longer requires UV print, wording adjusted to cover the case that issuer requires UV print.		

Mastercard no longer requires a UV print on the cards. Anyhow, some issuers still request it.

If UV print is present, then it shall not show any Level 1 defects, and should not show any Level 2 defects according to the below Defect Classification.

9.1.32.1 Defects Classification:

Level 1

- Type and color do not comply with the specific product requirement.
- Visible under daylight.
- Not visible under UV light.
- Card core or overlay are not neutral under UV light

Level 2

- Intensity lower than the reference sample cards but still clearly visible.
- Size and positioning do not comply with the product specific requirement.

Cards where the UV print has a Level 1 defect shall not be supplied.

Cards where the UV print has a Level 2 defect may be supplied, but corrective actions shall be defined, executed, verified and documented to correct and prevent reoccurrence of the problem.

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

9.1.33 #3035#: Layout and Printing – Printed Security Elements

CQM Tag	#3035#		
CQM Requirement	9.1.33 #3035#: Layout and Printing – Printed Security Elements		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#7110#		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The required printed security elements (e.g. first four digits of the BIN, dating legends, etc.) shall comply with [CDS].

These security elements shall appear with adequate contrast against their background.

9.1.34 #3036#: Hologram (including PBM)

CQM Tag	#3036#		
CQM Requirement	9.1.34 #3036#: Hologram (including PBM)		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	#7120#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up, recheck required each 1000 items produced.		

9.1.34.1 General

The Hologram is a security device which is typically hot-stamped onto the card's surface.

Unless stated otherwise, the term Hologram as used in this requirement refers to the Mastercard Hologram products such as Mastercard Security Holograms and the Mastercard Premium Brand Mark ("PBM").

The vendor shall specify clearly in the applicable production specification which Hologram(s) shall be applied to a specific card.

If a magnetic stripe with a surface having an appearance similar to a Hologram is applied to the card, e.g. Mastercard's HoloMag stripe, these requirements apply also to the image on the magnetic stripe, but the requirements related to the magnetic stripe underneath

the visible image, and its magnetic performance and requirements related to its encoding shall apply in the same way as if the image on top of the magnetic stripe were not present.

For the nominal positions this requirement refers to [CDS], and for the nominal dimensions and the position of the image on the hologram relative to the edge of the hologram to [MFS]. In case of contradictions between nominal positions and dimensions of Holograms, [CDS] and [MFS] shall be given priority over provisions defined in this document.

Tolerances for these nominal positions and dimensions are defined in this document, and in case of contradictions between tolerances of nominal positions and dimensions of Holograms, provisions defined in this document shall be given priority over those defined in [CDS] and [MFS].

9.1.34.2 Hologram Position

The position of the Hologram relative to the edges of the card shall comply with the definition in [CDS] ± 0.3 mm.

9.1.34.3 Hologram Width and Height

The width and height of the Hologram shall comply with the definition in [MFS] ± 0.1 mm.

9.1.34.4 Position of the Hologram Image relative to the Hologram's edges

The position of the Hologram Image relative to the Hologram's edges shall comply with the definition in [MFS] ± 0.3 mm.



Note

On a roll of holograms, there are reference blocks corresponding to each hologram. [MFS] defines a tolerance for the distance between reference blocks corresponding to two subsequent holograms on the hologram reel of ± 0.8 mm. This tolerance is necessary as the hologram supplier is permitted to splice rows of holograms to achieve the number required for a roll of holograms. This tolerance does not influence the tolerances defined in this section. For positioning an individual hologram, the reference blocks corresponding to that hologram must be used, not the reference blocks corresponding to another hologram.

The position of the Hologram Image relative to the top and bottom edge of a HoloMag stripe shall be centred with a tolerance of ± 2.11 mm and no part of the line of globes may be cut off by the upper and lower edge of the HoloMag stripe.

If the Hologram Image is a continuous and repetitive pattern and the positioning of the pattern is not defined in [CDS] or [MFS], e.g. the pattern on the HoloMag magnetic stripe

in the direction of the width of the card, then the defined positioning tolerance does not apply for that direction.

9.1.34.5 Clear edge around the Hologram Image

If part of the hot-stamped reflective surface structure is a clear edge with a defined width defined in [CDS], as is the case for the PBM, then the tolerance of the width of this clear edge shall comply with the nominal value defined in [CDS] or [MFS] ± 0.2 mm.

9.1.34.6 Visual Aspect

The type, design, and color of the hologram shall comply with the applicable requirements defined in [CDS] and [MFS].

A hologram is permitted to show the following visual defects before it is applied to a card:

- A maximum of 2 Spot Defects within the stamp area of a single hologram:
 - in the area of the discs with a maximum dimension of 0.38 mm.
 - in the area outside of the discs, the background plane containing the word Mastercard, with a maximum dimension of 0.50 mm.
- Scratches that do not transfer to the hot stamped image on the card.
- Scuff marks that do not affect the reflective layer
- Intermittent surface scratches that do not affect the reflective layer

A single hologram is permitted to show the following visual defects once it is applied to a card:

- A maximum of 2 Spot Defects:
 - in the foreground area, eg the area of the discs, with a maximum dimension of 0.38 mm; or
 - in the background area, eg the area outside of the discs, with a maximum dimension of 0.50 mm.
- Scuff marks that do not affect the reflective layer
- Surface scratches that do not affect the reflective layer



Note

Spot Defects are discolorations or holes in the metalized layer of the hologram.

A hologram applied onto a card shall be free of bubbles easily visible to the naked eye.

The edge of the hologram applied to a card shall be straight and free of irregularities easily visible to the naked eye.

The hologram's appearance shall be free of imperfections such as foreign materials and scratches easily visible to the naked eye except those explicitly permitted above. If [CDS] or [MFS] defines more stringent cosmetic requirements, then these shall be met in addition.

9.1.34.7 Adhesion

When the card is used in a card reader, the Hologram shall remain intact and not shed particles into the card reader.

Hologram particles shall not pollute the magnetic stripe or the contact area of the ICM during or as a consequence of normal storage, handling, and use of the card.

To ensure this, the Hologram shall not show to the naked eye holes, irregular edges, or other indications of removed material after being subjected to an Adhesive Tape test using an adhesive tape, with an Adhesion to Steel (adhesive strength) of (10 ± 1) N per 25 mm width¹⁴ or 4 N/cm width, tested in accordance with IEC 60454-2.

Test Method: **#7120#: Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) –Aspect and Shape, Size and Positioning**

For additional testing the following list of adhesive tests and their Adhesion to Steel (adhesive strength) may be useful:

Tape	Adhesion to Steel (adhesive strength) at 10 mm width	Adhesion to Steel (adhesive strength) at 25 mm width
Scotch Magic Tape 810	2.5	6.35
Scotch Tape 600	3	7.5
3M Masking Tape 401+	4	10
Scapa 8010-B	5	12.5
Intertape LA26	6.6	16.5

9.1.35 #3037#: Signature Panel

CQM Tag	#3037#
CQM Requirement	9.1.35 #3037#: Signature Panel

¹⁴ (10 ± 1) N per 25 mm width is app 4 N/cm or 36 oz./in. An adhesive tape with this adhesive strength is the 3M Masking Tape 401+.

CB Requirements - Requirements applicable to the component CB
General - applicable to all CB independent of the interface

Applicable to Entity	Vendor		Subcontractor	
Applicable to Stage	Design	Qualification		Production
Applicable to CQM Products	- Any Cardbody - IC Card produced using an IL containing the IC - Any InterActive Card			
Test Method	#7120#			
Default CQM Q-Plan:				
CQM Qualification	Minimum Sample Size: 1			
CQM Monitoring	1 item every Set-up, recheck required each 1000 items produced.			

The signature panel is a security device that may be hot-stamped, printed or paper based according to the applicable Product Rules, and that is applied onto the card.

9.1.35.1 Type and Color:

Type and color of the signature panel shall comply with the requirement included in [CDS].

9.1.35.2 Positioning and Size:

The Signature Panels positioning and size shall comply with the requirements included in [CDS].

The signature panel shall not interfere with the magnetic stripe, the embossing and the ICM area. It is recommended maintaining a distance of at least 1 mm between the different elements.

9.1.35.3 Aspect

No visible holes are allowed. Its edges shall appear straight to the naked eye.

9.1.35.4 Adhesion

When the card is used in a card reader, the signature panel shall remain intact. Furthermore, signature panel particles may not pollute the magnetic stripe or micro module.

Test Method: **#7120#: Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) –Aspect and Shape, Size and Positioning**

9.2 Contactless – Requirements applicable to CB including antennae

9.2.1 #3038#: ICC - Metallic Inks and other layers containing metals shall not affect RF Performance

CQM Tag	#3038#		
CQM Requirement	9.2.1 #3038#: ICC - Metallic Inks and other layers containing metals shall not affect RF Performance		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card having a Contactless Interface - IAC having a Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

When using metallic ink or layers containing metal in products that feature an electromagnetic interface, special care shall be taken that the electro-mechanical characteristics are not adversely affected. The Vendor shall demonstrate through relevant tests that use of a metallic ink or layer containing metal in the CB construction does not adversely affect the electro-magnetic performance of the finished card to push it out of the permitted tolerances or that the change in electro-magnetic characteristics has been sufficiently compensated through other means, e.g. adjustment of the antenna. Also see the following requirements for related information about the electro-magnetic performance:

- **#3061#: Verification of Antenna Functionality, and Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")**
- **#3062#: Resonance Frequency**
- **#3063#: Q-Factor**
- **#3064#: Reading Distance**

9.2.2 #3039#: ICC – Surface Stability – Inlay not affecting Visual Aspect of Card

CQM Tag	#3039#		
CQM Requirement	9.2.2 #3039#: ICC – Surface Stability – Inlay not affecting Visual Aspect of Card		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- CB containing an inlay (but no IC) - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Batch, recheck required each 1000 items produced.		

The process of inserting an inlay into the core of the card shall not create any visible distortion of any part of the printed image required by Mastercard's Card Design Standards, and may only cause distortions of the issuer related aspects of the printed image if the issuers has accepted those distortions in writing.

Except the above permitted deviation, the appearance of a card with an inlay shall not deviate from the same card without an inlay when observed under normal daylight and at a distance of 40 cm by a normal sighted observer for a time of approximately 2 s.

9.2.3 #3040#: Suitability of the IL, ICC, and IAC for Visual Personalization

CQM Tag	#3040#		
CQM Requirement	9.2.3 #3040#: Suitability of the IL, ICC, and IAC for Visual Personalization		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM including ISO/IEC 14443 Antenna - Any Inlay Activity - Any Cardbody - Any IC Card - Any IACIL - Any InterActive Card		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		



Note

This requirement only applies if the finished ICC is intended to be subjected to thermal transfer printing or other printing methods that are sensitive to surface irregularities, typically during personalization.

To ensure that surface irregularities caused by antenna or module do not adversely affect any such printing process of the ICC, the Vendor shall demonstrate through adequate test prints during qualification that the ICC's construction is suitable for such printing technologies.

For thermal transfer printing, printing a 100% coverage onto the areas foreseen for visual personalization is a recommended approach.

For other printing technologies, printing checkerboard patterns with a square size of 1 mm x 1 mm might be found more useful.

For character based printing technologies such as indent printing, personalizing 'worst case characters', such as '8' or 'W' might be useful.

The vendor is responsible for defining and using adequate test patterns and other details of this test to ensure the selected printing methods achieve the desired results without problems. The test shall address any area and side intended to be subjected to such printing.

Test Method: It is up to the Vendor to develop and implement an adequate test regime to ensure the IL, ICC, or IAC respectively is suitable for the intended printing technologies.

10 CB and ICC Requirements - Requirements applicable to the components CB, ICC, and IAC

This chapter defines the Product Requirements applicable to the components CB, ICC, and IAC.

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10.1 General – Requirements applicable independent of the interface

10.1.1 #3041#: Bending Stiffness

CQM Tag	#3041#		
CQM Requirement	10.1.1 #3041#: Bending Stiffness		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	#8080#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Editorial changes only: content replaced by reference to 7810		

The card shall comply with the requirement *ISO/IEC 7810 Bending stiffness*.

Test Method: **#8080#: Bending Stiffness [IS10373-1]**

10.1.2 #3042#: Dynamic Bending Stress ^[IS7810]

CQM Tag	#3042#		
CQM Requirement	10.1.2 #3042#: Dynamic Bending Stress [IS7810]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	#8140#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): IAC related items added from CSI Testplan for fingerprint cards		

The card shall not show any cracks¹⁵ on its surface and it shall remain fully functional¹⁶ after a total of 2000 bending cycles. The card shall remain fully functional after a total of

¹⁵ A crack is a break in the surface of the card. A local change in color, even if linear, where the surface above is unbroken, is not a crack.

¹⁶ The term 'functional' includes the functionality of a present Magnetic Stripe

4000 bending Cycles. Cracks and other mechanical defects shall not impact the functionality of the magnetic, electric, and electromagnetic interface.

Test Method: **#8140#: Dynamic Bending Stress [IS10373-1]**

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (layers, materials, ICM, process flow and parameters) produced during the preceding interval, but is not required to take into account every different artwork.

CQM recommends that testing is done beyond the required minimum number of cycles, e.g. up to 6000 cycles instead of 4000 cycles. Doing so might provide the vendor with data about the actual performance of the product (as opposed to 'just about compliant') and provide a rationale for reducing the sampling frequency, if the vendor could show that the product is performing consistently much better than required.

For personalized cards conformity with this requirement is only required to be monitored if:

- The cards are intended for mechanically stressful personalization, such as embossing and indent, and
- The bending test results of the unpersonalized cards provide evidence that the overall warpage of the cards immediately¹⁷ after test is more than 5 mm¹⁸, or cracks are visible that extend through the full thickness of the card, with the exception of the cavity containing the ICM, where cracks extending through the material behind the cavity are permitted.

IAC containing biometric functionality:

- Shall comply with **#2043#: Functional Verification of Biometric Sensors** after 2000 cycles; and
- Should comply with **#2043#: Functional Verification of Biometric Sensors** after 4000 cycles

If the IAC fails this test before the recommended ("should") number of cycles is reached, the Vendor shall obtain a CSI letter or the product (and might have to do so anyway), and report the number of cycles the biometric functionality survived with an accuracy of 500 cycles or better.

10.1.3#3043#: Dynamic Torsional Stress

CQM Tag	#3043#		
CQM Requirement	10.1.3 #3043#: Dynamic Torsional Stress		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production

¹⁷ "immediately" shall be understood that the flatness check is made within 1 hour of the final bending cycle.

¹⁸ Warpage shall be measured in accordance

CB and ICC Requirements - Requirements applicable to the components CB, ICC, and IAC

General – Requirements applicable independent of the interface

Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card
Test Method	#8150#
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 8
CQM Monitoring	10 items every Year.
Changelog:	
After V2.19.1	New: Imported from CSI.

The card shall not show any cracks on its surface and it shall remain fully functional¹⁶ after a total of 1000 torsion cycles.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (layers, materials, ICM, process flow and parameters) produced during the preceding interval, but is not required to consider every different artwork.



Note

Caution is recommended when selecting test equipment for this test. A range of manufacturers are offering test equipment that is substantially not in conformance with ISO/IEC 10373-1, the standard defining this test. ISO/IEC 10373-1 requires both ends of the card to be twisted by $\pm 15^\circ$ in opposite directions. To achieve the same amount of torsion when only twisting one end of the card, as most of the available test equipment do, the single end shall be twisted by $\pm 30^\circ$.

Test Method: **#8150#: Dynamic Torsional Stress [IS10373-1]**

10.1.4 #3069#: Extended Dynamic Torsional Stress

CQM Tag	#3069#		
CQM Requirement	10.1.4 #3069#: Extended Dynamic Torsional Stress		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any InterActive Card		
Test Method	#8150#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	10 items every Year.		
Changelog:			
After V2.19.1	New: Imported from CSI.		
After V2.22.1	Editorial changes only: tag changed from #3043# to #3069# as was duplicate		

The card shall not show any cracks on its surface and it shall remain fully functional¹⁶ after a total of 1000 torsion cycles.

The card should not show any cracks on its surface and it should remain fully functional¹⁶ after a total of 6000 torsion cycles.

The vendor shall retain test results, including those for the recommended number of cycles, and make them available to Mastercard upon request.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (layers, materials, ICM, process flow and parameters) produced during the preceding interval, but is not required to consider every different artwork.

Test Method: **#8150#: Dynamic Torsional Stress [IS10373-1]**

10.1.5 #3044#: Durability - Temperature and Humidity Exposure

CQM Tag	#3044#		
CQM Requirement	10.1.5 #3044#: Durability - Temperature and Humidity Exposure		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	#8091#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 3		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): modified to accommodate CSI requirements for biometric cards		

The card shall remain functional as intended according to its specification for 3 years after it is issued to the cardholder under the following climatic conditions:

- Humidity 5 % r.H. to 95 % r.H.
- Temperature 0 °C to 60 °C

Also, storing the card under the following conditions during this time shall not affect the card's functionality:

- Humidity 5 % to 95 % r.H
- Temperature -35 °C to 60 °C

The changes of size shall be:

- At 60 °C $\Delta S < [+0.3\%, -0.5\%]$
- At 50 °C $\Delta S < [+0.3\%, -0.3\%]$

By default compliance shall be tested at 60 °C. If the card conforms to the ΔS requirement defined at 60 °C and remains fully functional, then the card shall be deemed compliant to this requirement, eg no retesting at 50 °C is required.

If the card contains biometric functionality and fails to remain fully functional after exposure at 60 °C, the Vendor needs to obtain a CSI letter for the card, and repeat testing conformity for this requirement at 50 °C and at 55 °C and report if the card remains fully functional after each of these exposures.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (layers, materials, process flow and parameters) produced during the preceding interval, but is not required to consider every different artwork and ICM.



Note

Compliance with this requirement shall be determined solely by using the test method defined below. CQM does not require that after the test method additional mechanical stress methods are executed to determine conformity with this requirement, eg Dynamic Bending Stress.



Note

Excessive storage before issuance may influence the durability of the CB or pICC after issuance. Card Vendors and Subcontractors shall ensure their customers know the conditions of uncritical storage before issuing (e.g. maximum time and climatic storage conditions), as proper functioning of the cards during their expected lifetime is in the interest of all parties involved. The storage conditions recommended by the Card Vendor or Subcontractor shall be respected.

Test Method: **#8091#: Durability – Dimensional Stability with Temperature and Humidity**

10.1.6 #3045#: Resistance to Heat

CQM Tag	#3045#		
CQM Requirement	10.1.6 #3045#: Resistance to Heat		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	#8110#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 3		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): modified to accommodate CSI requirements for biometric cards, clarified that advanced functionality must survive exposure		

The card shall not show:

- A deflection greater than 10 mm
- Delamination
- A significant variation of the visual aspect

- Loss of specified functionality

after being exposed for 4 hours to the maximum storage temperature defined in **#3044#: Durability - Temperature and Humidity Exposure**.

By default, compliance shall be tested at the maximum storage temperature defined in **#3044#: Durability - Temperature and Humidity Exposure**. If the card conforms to this requirement defined maximum storage temperature defined in **#3044#: Durability - Temperature and Humidity Exposure** and remains fully functional, then the card shall be deemed compliant to this requirement.

If the card contains biometric, or other advanced functionality like displays, and fails to remain fully functional after exposure at 60 °C, the Vendor needs to obtain a CSI letter for the card (and might have to do so anyhow), and repeat testing conformity for this requirement at 50 °C and at 55 °C and report if the card remains fully functional after each of these exposures.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall take into account the different card constructions (layers, materials, process flow and parameters) produced during the preceding interval, but is not required to take into account every different artwork or ICM.

Test Method: **#8110#: Resistance to Heat** [IS10373-1]

10.1.7 #3046#: Resistance to Chemicals

CQM Tag	#3046#		
CQM Requirement	10.1.7 #3046#: Resistance to Chemicals		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	#8190#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): referring now to 7810.		

The CHD (ICC, IAC) shall comply with the requirements regarding Resistance to chemicals defined in:

- *ISO/IEC 7810 Resistance to chemicals* (both the requirements defined, the one in section *Card characteristics* and the one in section *Criteria for cards containing IC's*),
- If the CHD contains a magnetic stripe, also the requirement defined in *ISO/IEC 7811-6 Resistance to chemicals*.
- If conformity with **#3058#: Solidity – Adhesion of ICM to Card** is required, then the sampling size for **#3058#: Solidity – Adhesion of ICM to Card** shall be at least 1 card per solution.

CQM considers the result of the test to be independent of the artwork. Conclusively the sampling for this test shall take into account the different card constructions (layers, materials, ICM, process flow and parameters) produced during the preceding interval, but is not required to take into account every different artwork.

Test Method: **#8190#: Resistance to Chemicals** *IS10373-1, ISO 7810*

10.1.8 #3047#: Extended Short-Term Resistance to Chemicals ^[IS7810], ^[ISO7811-6]

CQM Tag	#3047#		
CQM Requirement	10.1.8 #3047#: Extended Short-Term Resistance to Chemicals [IS7810], [ISO7811-6]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any InterActive Card		
Test Method	#8190#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): Made applicable for IAC		

The card shall comply with all the product requirements defined in this document after being submerged into defined solutions for short-term exposure except for Fuel B for an extended interval of 60 minutes.

The card shall comply with all the product requirements defined in this document after being submerged into Fuel B for an interval of 1 minute, and it should comply with all the product requirements defined in this document after being submerged into Fuel B for an extended interval of 60 minutes.

The vendor shall retain test results, including those for the extended exposure to Fuel B, and make them available to Mastercard upon request.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (layers, materials, ICM, process flow and parameters) produced during the preceding interval, but is not required to consider every different artwork.

Test Method: **#8190#: Resistance to Chemicals** *IS10373-1, ISO 7810*

10.1.9 #3048#: Use Conditions

CQM Tag	#3048#		
CQM Requirement	10.1.9 #3048#: Use Conditions		
Applicable to Entity	Vendor	Subcontractor	

CB and ICC Requirements - Requirements applicable to the components CB, ICC, and IAC

General – Requirements applicable independent of the interface

Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

Where conditions of use and storage deviate from what a card holder might expect from a normal card, the Vendor shall provide adequate guidance.

10.1.10 Flammability

No requirement with respect to flammability of the card is defined in this document.

10.1.11 #3049#: Toxicity, Health and Environment

CQM Tag	#3049#		
CQM Requirement	10.1.11 #3049#: Toxicity, Health and Environment		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<div>- Any IC Activity</div> <div>- Any ICM Activity</div> <div>- Any Inlay Activity</div> <div>- Any Cardbody</div> <div>- Any IC Card</div> <div>- Any IACICM Activity</div> <div>- any Biometric Sensor Module</div> <div>- Any IACIL</div> <div>- Any InterActive Card</div>		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

Taking the relevant national and/or regional regulations into consideration, the CHD and its components shall present no toxic hazard in the course of normal use. The definition of "normal use" includes issuance and disposal of the CHD.

Where the construction of the CHD requires special measures to avoid toxicity, health or environmental risks, the Vendor shall take adequate measures to provide sufficient guidance to subsequent processors of the product and to the card holder.



Note

Vendors are advised to research and respect national legislation related to these aspects in the country of production as well as the country of issuance of the CHD. National legislation and complying with it is outside of the scope of this document.

Test method: no test method related to this requirement is defined here.

During an audit the Vendor shall be able to demonstrate that the relevant material safety data sheets for the component have been acquired and reviewed and adequately considered, typically in a risk assessment.



Note

This requirement does not require the Vendor to obtain or create an MSDS for the card itself. The Vendor is only expected to review the MSDS for the components of the CHD and work out if this causes the card to constitute a risk.

10.1.12 #3050#: ESD Conductivity - ESC

CQM Tag	#3050#		
CQM Requirement	10.1.12 #3050#: ESD Conductivity - ESC		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card - Any InterActive Card		
Test Method	#8250# #8260#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 5		
CQM Monitoring	None required		
Changelog:			
After V2.22	Technical changes (incl. editorial changes): Permitted maximum aligned with threshold for obtaining CSI letter, permitted maximum increased to 25% for scenarios 5 and 6.		
After V2.22.1	Technical changes (incl. editorial changes): Clarification added how to handle false positives due to certain magnetic stripes.		

ESD Conductivity, subsequently called "ESC" is the ability to conduct an electrostatic discharge ("ESD") from one part of the surface to another, such as a card conducting an ESD from the card holder touching the protruding end of the card into the terminal, potentially causing malfunction or damage to the terminal.

The Card shall not conduct more than 15% of the energy of an electrostatic discharge ("ESD") at 8 kV into a terminal in contact scenarios 1 to 4, and not more than 25% in contact scenarios 5 and 6.

Conformity with this requirement may be assumed, if:

- all components of the CHD are either known to not conduct ESD at voltages of 8 kV;
or

- at least one component is conducting ESD, but does not provide a conductive path over a distance of more than 30 mm, and is insulated from any other conductive component of the card such that bridging of ESD between the conductive components up to a voltage of 8 kV is prevented; or
- if the component is a homogenous material and passes the ESD Conductivity test for card components, #8260#: ESC – ESD Conductivity of Materials.

Materials that are known to not conduct ESD at voltages of 8 kV in CHD constructions include:

- Transparent or white PVC, PETG, PC films
- Mastercard signature panels

Materials that are known to not provide a conductive path over a distance of more than 30 mm include:

- ICM for producing ICC with 6 or 8 contacts, where the exposed surface has a maximum dimension of less than 30 mm when measured parallel to a card edge;
- ICM for producing ICC with 6 or 8 contacts with no exposed antenna on the surface of the card, where the exposed surface has a maximum dimension of less than 30 mm when measured parallel to a card edge;
- Mastercard holograms that are not in the form of the magnetic stripe; and
- Mastercard PBM¹⁹.

Cards that are not known to be made solely of components known not to conduct ESD shall pass the ESC test defined in #8250# by showing they conduct less than 15% of an 8 kV ESD. If the cards fail this test, they must be subjected to Mastercard's CSI Process.

Materials may be tested using #8260# to establish they are not conducting ESD. This may be assumed if in all contact scenarios defined in #8260#, the relative charge conducted by the material sample is less than 8% of an 8 kV ESD.

Certain magnetic stripes are known to cause a failure in Scenario 6 of the test method. Scenario 6 (as well as 5 and 7) has been introduced to detect low resistance conductivity in certain IAC constructions, for example cards with an ISO/IEC 7816-2 contact module connected to a fingerprint sensor in a separate location of the card. If the card fails scenario 6 only, then the card may be assumed compliant with this requirement if all of the following conditions are fulfilled:

- the only potentially conductive feature on the backside of the card is the magnetic stripe, and
- the same card construction without the magnetic stripe is fully compliant with this requirement, thus passes the test in all scenarios.

If the card fails more scenarios than just Scenario 6, or it cannot be determined with certainty that the cause of the failure in Scenario 6 is solely the magnetic stripe, then the

¹⁹ PBM is MasterCard's Premium Brand Mark, a hologram like representation of the two globe symbol.

card is not compliant with this requirement, and this non-compliance must be covered by a CSI letter to consider the card CQM compliant.

Test method for cards: **#8250#: ESC – ESD Conductivity of Card**

Test method for homogenous materials: **#8260#: ESC – ESD Conductivity of Materials**



Note

Cards that do not comply with this requirement must be subject to Mastercard's CSI Process!



Note

Exposure of cards to testing for conformity with this requirement may cause electrical damage to the components inside the card. Such electrical failure should not be interpreted as evidence for non-conformity with standardized ESD robustness requirements. The ESD Conductivity test is not a precise ESD Robustness test of components inside the card, its purpose is to determine if the card increased the risk of ESD from the cardholder into the terminal.

10.1.13 #3067#: Suitability for an Identification Notch

CQM Tag	#3067#		
CQM Requirement	10.1.13 #3067#: Suitability for an Identification Notch		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Inlay Activity - Any Cardbody - Any IC Card - Any IACIL - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	New		
After V2.22	Technical changes (incl. editorial changes): Major rewrite to accommodate greater tolerance for placing notches defined in CDS		

Mastercard has foreseen in [CDS] a range of optional Identification Notches located in the lower right corner of the card through their 'Mastercard Touch Program', to aid visually impaired cardholders orienting and identifying the card. By default notches are permitted in the area permitted for notches as marked by the 2.1 mm x 15.7 mm rectangle in the lower right of the card shown in **Figure 10 - Area permitted for notches**.



Note

While CQM currently anticipates that the majority of notches will be created during CB production as part of the punching process, it is currently permitted to add a notch at the time of personalisation, for example as part of instant issuance. Hence damage to

functional elements in the area permitted for notches may occur even if the CB vendor does not foresee creating a notch themselves.

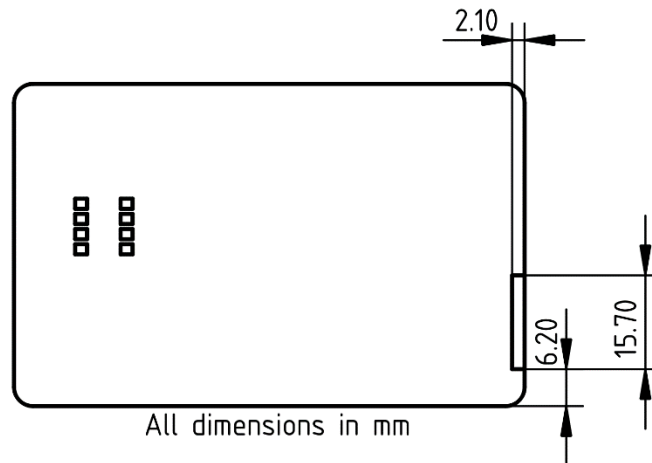


Figure 10 - Area permitted for notches

If the area permitted for notches is not free of functional elements embedded into the card, for example an antenna, then such functional elements can become damaged by the process creating the notch.

To ensure unwanted damage of functional elements embedded into the card is prevented, an IL, CB, ICC, or IAC Vendor providing IL or cards to other vendors potentially creating notches in cards shall document the card's capability to accommodate notches in the product specification and communicate this capability to these other vendors.

If no functional elements are located in the area permitted for notches, then the IL, CB, ICC, or IAC Vendor may declare that the IL, CB, ICC, or IAC is fully compatible with the 'Mastercard Touch Program'.

If any functional elements embedded into the card are in the area permitted for notches, then the Vendor shall define a Notch Safe Zone of a size of 2.1 mm x 13.7 mm, located at a distance N from the lower edge of the card within the area permitted for notches, as shown in **Figure 11 - Notch Safe Zone**. If the Vendor then ensures that Notch Safe Zone is free of functional elements embedded into the card, the Vendor may declare that the IL, CB, ICC, or IAC is compatible with the 'Mastercard Touch Program' for notches located in the Notch Safe Zone but shall only communicate this together with the size and location of the Notch Safe Zone.

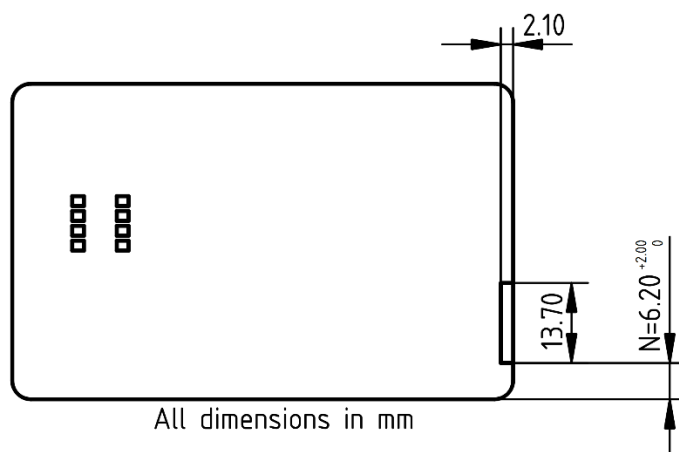


Figure 11 - Notch Safe Zone

An IL vendor specifying that the IL is suitable for producing cards with a notch shall:

- Specify this in the IL specification
- Specify the permitted production tolerances for the card production process within which it is ensured that the card's Notch Safe Zone is free of functional elements contained in the IL

A card vendor producing a card that is suitable for a notch shall ensure that the card production tolerances are sufficiently controlled to ensure no functional elements end up inside the Notch Safe Zone.

Otherwise, the Vendor shall not communicate that the IL, CB, ICC, or IAC is compatible with the 'Mastercard Touch Program'.

10.1.14 #3100#: Cards made of materials other than newly produced PVC, and cards with an associated environmental claim – Requirement to maintain a valid CSI Letter (and CEC Certification if applicable)

CQM Tag	#3100#		
CQM Requirement	10.1.14 #3100#: Cards made of materials other than newly produced PVC, and cards with an associated environmental claim – Requirement to maintain a valid CSI Letter (and CEC Certification if applicable)		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - Any IC Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): Added reference to CEC Certification.
After V2.22	Technical changes (incl. editorial changes): clarification that embedding CQM qualified iacIL, iacICM, BSM in card do not count.

A Vendor shall maintain a CSI letter for each card construction containing a significant percentage of non-standard materials, and for each card construction the Vendor makes a related environmental claim about, the latter independent of the percentage of non-standard materials.

A significant percentage in the sense of this clause is more than 20% by weight or volume of the finished, unpersonalised card.



Note

To calculate the % of card material by volume, divide the thickness of the layers of the material to determine the percentage of by the thickness of all card materials together. Ignore materials that are only present in small areas of the card, such as ICMs, holograms, or antenna wire, but include materials that extend over the whole width and height of the card, such as the carrier film of an AIL.

Non-standard materials are all materials that are not newly produced PVC, such as:

- recycled PVC,
- PET, PETG, and other polyesters,
- PC,
- materials claimed to be biodegradable and compostable, and
- other materials supported by marketing claims of being environmentally friendly due to accelerated breakdown of the molecular structure under certain conditions.

Non-standard materials in the sense of this clause are not:

- CQM approved contactless inlays, such as AIL, PIL, DIL, iacIL,
- CQM approved ICM, iacICM, BSM,
- Offset and screen printing inks applied during the manufacturing process of the card,
- Mastercard signature panel and hologram (including PBM).

Making a related environmental claim related to a Mastercard branded card requires that this has been checked with CSI beforehand, and CEC Certification where applicable, independent of the percentage of the material or component the environmental claim is related to or based upon.

Examples for related environmental claims:

- "This card is more environmentally friendly because its overlay is made of PETG",
- "This card is more environmentally friendly because its black ink is obtained from organically grown squid".

See **#B210# Non-standard card materials, environmental claims, and CSI** for some additional information.

10.1.15 #3110#: IAC – Interactive Cards – Requirement to maintain a valid CSI Letter

CQM Tag	#3110#		
CQM Requirement	10.1.15 #3110#: IAC – Interactive Cards – Requirement to maintain a valid CSI Letter		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IACICM Activity - any Biometric Sensor Module - Any IACIL - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

IAC are cards containing interactive functionality that extends beyond that of common ICC, such as displays, biometric sensors, batteries, input devices like buttons and keypads.

Examples for IAC are:

- Cards with a dynamic CVC2 display,
- Cards with a fingerprint sensor,
- Cards with a keypad to enable functionality,
- Cards with a matrix display,



Note

Cards with a LED indicating the card is exposed to a card reader’s RF-field, and no other advanced functionality, are no longer considered IAC, but are considered ledICC.

Examples for iacIL are:

- Inlay containing a battery and circuitry to power and connect a fingerprint sensor,
- Inlay containing a display and the circuitry to generate a dynamic CVC2.

A Vendor shall maintain a valid CSI letter for certain IAC card constructions, and for certain components intended to be used for the manufacturing of IAC.

IAC card constructions, and their components iacICM, iacIL, BSM, that are fully covered by CQM and do no longer (as of 2024) require a CSI letter:

- IAC with a fingerprint sensor

CB and ICC Requirements - Requirements applicable to the components CB, ICC, and IAC
General – Requirements applicable independent of the interface

- IAC with a dCVx display, usually made from a display module or inlay containing an electrophoretic or LCD display, and optionally a display driver, passive components, a battery
- IAC with a matrix display

IAC constructions, and their components iacICM, iacIL, BSM, that are not fully covered by CQM and still require (as of 2024), or may still require, a CSI letter:

- IAC including an image or voice sensor
- IAC including a sound generating element
- IAC including pushbuttons or capacitive sensors
- IAC including other non-standard components
- IAC with innovative display solutions beyond an electrophoretic or LCS segment or matrix display.

In addition, any IAC construction that is not fully CQM compliant requires a CSI letter according to **10.1.17 #3130#: Products that are not compliant with applicable CQM requirements – Requirement to maintain a valid CSI Letter**.



Note

In case of uncertainty if a CSI letter is required, contact csi.security@mastercard.com.

See **#B220# InterActive Cards ("IACs"), including cards with integrated biometric sensors, and CSI** for some additional information.

10.1.16 #3120#: Pilot, innovative, and interactive cardholder identification products requirement to undergo CQM Audits depending on annual production volume

CQM Tag	#3120#		
CQM Requirement	10.1.16 #3120#: Pilot, innovative, and interactive cardholder identification products requirement to undergo CQM Audits depending on annual production volume		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Inlay Activity - Any Cardbody - Any IC Card - Any IACICM Activity - any Biometric Sensor Module - Any IACIL - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

Changelog:	
After V2.22	New

Pilot, innovative, and interactive cardholder identification products shall be subject to CQM Audits depending on their annual production volume:

Annual volume of less than 5000 units/a:

The vendor shall audit their subcontractors of CQM certifiable components.

The Vendor's operations applicable to this product are not required to undergo CQM audits. The Vendor may request a CQM Audit of these operations.

The Vendor's subcontractors and suppliers of CQM certifiable components of such product are not required to undergo CQM audits. The Vendor may request CQM Audits of their subcontractors and suppliers of CQM certifiable components of such product.

The product shall be covered by a CSI letter before the Vendor ships Mastercard branded units.

The vendor does not receive a CQM label for this product, unless the vendor decides to voluntarily comply with the rules for an annual volume between 5000 and 50000 units/a.

Annual volume between 5000 and 50000 units/a:

The vendor shall audit their subcontractors of CQM certifiable components, and make the audit reports available to their CQM Auditor upon request.

The Vendor's operations applicable to this product are required to undergo regular CQM audits.

The Vendor's subcontractors and suppliers of CQM certifiable components of such product are required to undergo CQM remote audits; the remote audit should consist of a 4 hour review call to verify the operations conducted by the supplier or subcontractor to provide CQM certifiable components for this product are conducted in line with the applicable CQM requirements; the auditor may increase the time needed for complex or multiple components. The Vendor may request on-site CQM Audits of their subcontractors and suppliers of CQM certifiable components of such product.

Where CSI is required for the type of product, the product shall be covered by a CSI letter before shipping Mastercard branded units

The vendor does receive a CQM label for this product.

Annual volume exceeding 50000 units/a:

The vendor shall audit their subcontractors of CQM certifiable components, and make the audit reports available to their CQM Auditor upon request.

The Vendor's operations applicable to this product are required to undergo CQM audits.

The Vendor's subcontractors and suppliers of CQM certifiable components of such product are required to undergo CQM audits.

Where CSI is required for the type of product, the product shall be covered by a CSI letter before shipping Mastercard branded units.

The vendor does receive a CQM label for this product.



Note

In case of uncertainty if a CSI letter is required, contact csi.security@mastercard.com.

10.1.17 #3130#: Products that are not compliant with applicable CQM requirements – Requirement to maintain a valid CSI Letter

CQM Tag	#3130#		
CQM Requirement	10.1.17 #3130#: Products that are not compliant with applicable CQM requirements – Requirement to maintain a valid CSI Letter		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Activity - Any ICM Activity - Any Inlay Activity - Any Cardbody - Any IC Card - Any IACICM Activity - any Biometric Sensor Module - Any IACIL - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		
Changelog:			
After V2.22	New		

CQM certifiable products that during qualification were found not compliant with at least one CQM requirement shall be covered by a CSI letter granted following the vendor disclosing the non-conformity to CSI.

See [#0582#: Design and Development – Product Qualification Plan](#) and [#0654#: Design and Development – Product Qualification Report](#) for additional information.

CQM certifiable products that were during monitoring found substantially not compliant with at least one CQM requirement shall be covered by a CSI letter granted following the vendor disclosing the non-conformity to CSI.

10.1.18 #3200#: CB, ICC, and IAC – Requirement to maintain a valid Mastercard Card Vendor Conformity Statement ("CVCS")

CQM Tag	#3200#		
CQM Requirement	10.1.18 #3200#: CB, ICC, and IAC – Requirement to maintain a valid Mastercard Card Vendor Conformity Statement ("CVCS")		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Card - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

Mastercard has in October 2019 announced AN 3253 – Revised Card Vendor Approval Process.

Mastercard AN 3253 clarifies how a Card Vendor, instead of having their own LoA for a Card Product, may re-use a LoA or CCS issued to their supplier (IC, ICM, or IL Vendor) together with their own Card Vendor Conformity Statement ("CVCS").



Note

AN 3253 is available via Mastercard Connect and launching the Technical Resource Center app.

Every card manufacturing site shall be covered by a valid CVCS.

A Card Vendor shall maintain for each contact only card product at least one of the following:

Case	Certificates required	Condition
ICC, contact only	A LoA covering IC, OS, and Payment Application, issued in the Card Vendor's name; OR A LoA or CCS covering IC, OS, Payment Application, issued in the IC, ICM, or IL Vendor's name	IC, ICM, OS as defined in the LoA or CCS.

A Card Vendor shall maintain for each Card Construction having a contactless interface (including dual interface products) at least one of the following:

CB and ICC Requirements - Requirements applicable to the components CB, ICC, and IAC
General – Requirements applicable independent of the interface

Case	Certificates required	Condition
ICC, has contactless interface	A LoA covering IC, OS, Payment Application, and IL, issued in the Card Vendor's name; OR A LoA or CCS covering IC, OS, Payment Application, and IL, issued in the IC, ICM, or IL Vendor's name	IC, ICM, OS, IL as defined in the LoA or CCS, Card Construction is the one covered by the LoA or CCS.

A Card Construction shall be considered differing from the one covered by the LoA or CCS, if at least one of the following differs between the Card Construction defined in the LoA or CCS and the Card Construction produced by the Card Vendor:

- IL material
- Antenna layout, antenna material, or antenna application technology
- IL and ICM vendor
- Card material, if the change affects the reading distance of the finished card (see #3064#)
- Metallic reflective layers
- Screen-printing inks that affect the reading distance of the finished card (see #3064#)
- Metal inserts or layers, including metal card bodies

10.2 Contactless – Requirements applicable to CB and ICC having a contactless interface

10.2.1 #3051#: Antenna Design and Module Location

CQM Tag	#3051#		
CQM Requirement	10.2.1 #3051#: Antenna Design and Module Location		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Cardbody - IC Card having a Contactless Interface - IAC having a Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	None required		

The antenna and the ICM shall not interfere adversely with other elements of the card, such as personalization and security elements.

To minimize such risk, the antenna design and the ICM location shall meet the following specifications:

- ISO/IEC 7810 and ISO/IEC 7811-1
- [CDS]

Test method: No method is defined here. The Vendor shall consider these requirements when designing the product and check them during qualification and report conformity in the qualification report.

In addition, the card construction shall conform to the following product requirements:

- **#2805#: Antenna Design**
- **#2806#: Antenna Design non-compliant with #2805# – IL Embossability**
- **#2809#: IC Location in IL, ilICC**
- **#2810#: Inlays and cards containing inlays – Specification of Personalization Restrictions**
- **#2811#: Recommendation – Maximum Size of Antenna**

11 ICC Requirements - Requirements applicable to the components ICC, and IAC

This chapter defines the Product Requirements applicable to the components ICC, and IAC, but not to the component CB.

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11.1 General – Requirements applicable to all ICC independent of the interface

11.1.1 #3052#: Card - Construction and Specification

CQM Tag	#3052#		
CQM Requirement	11.1.1 #3052#: Card - Construction and Specification		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Card - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The vendor shall specify the construction of the Card and document the specification. Examples for acceptable forms for a specification are written documents, tables listing requirements and product details, and parts lists in ERP systems.

ICC shall be produced using one of the two principal manufacturing technologies by:

- combining the CB and the ICM using adequate technologies, or
- laminating an inlay already containing the IC, and optionally an antenna during the CB manufacturing process into an ICC.

The construction of a ICC shall be well defined and documented, including:

- CB used
- ICM used
- IL used
- Adhesives used
- Technology and materials used to establish the interconnection between ICM and antenna
- Manufacturing processes and parameters (explicitly in the specification or by reference to documents defining the processes)
- Test Processes and Criteria (explicitly or by reference e.g. to a Quality Control Plan)
- Qualification Criteria (explicitly or by reference e.g. to a Qualification Plan)

The construction of an IAC shall be well defined and documented, including:

- ICs used
- All components and materials used
- Adhesives used
- Technology and materials used to establish the interconnection between ICM and antenna

ICC Requirements - Requirements applicable to the components ICC, and IAC

General – Requirements applicable to all ICC independent of the interface

- Manufacturing processes and parameters (explicitly in the specification or by reference to documents defining the processes)
- Test Processes and Criteria (explicitly or by reference e.g. to a Quality Control Plan)
- Qualification Criteria (explicitly or by reference e.g. to a Qualification Plan)

Test Method: no test method.

11.1.2 #3054#: 3 wheel Test Robustness

CQM Tag	#3054#		
CQM Requirement	11.1.2 #3054#: 3 wheel Test Robustness		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC Card produced using an ICM containing the IC - IAC produced using an ICM containing the IC		
Test Method	#8210#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Month.		



Note

The applicable requirement for ICC that do not have the IC located behind the ISO/IEC 7816-2 contact plate is #3057# and not #3054#, with the location of the IC being the MSA.

The ICC shall remain functional after 2 x 50 cycles according to #8210#: 3 wheel Test.



Note

2 x 50 cycles refer to the 50 cycles contacts up and 50 cycles contacts down as defined in #8210#: 3 wheel Test

The ICC shall pass the test for F= 8 N.

During qualification CQM recommends repeating the test with increasing F for 2 x 50 cycles at each force until the ICC is no longer functional. Forces tested in addition should be 10 N and 12 N.

Mastercard strongly recommends that the ICC passes at least 2 x 50 cycles with F = 10N before it fails functionally during production monitoring.

Mastercard strongly recommends that the ICC passes at least 2 x 50 cycles with F = 12N before it fails functionally during production qualification.

CQM considers the result of this test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (ICM, cavity

ICC Requirements - Requirements applicable to the components ICC, and IAC
General – Requirements applicable to all ICC independent of the interface

dimensions, milling and embedding process flow and parameters) produced during the preceding interval, but is not required to consider every different artwork.

Test Method: **#8210#: 3 wheel Test**

11.1.3 #3055#: Wrapping Test Robustness

CQM Tag	#3055#		
CQM Requirement	11.1.3 #3055#: Wrapping Test Robustness		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC Card produced using an ICM containing the IC - IAC produced using an ICM containing the IC		
Test Method	#8220#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Day.		

The mICC (ICC produced from CB and ICM) shall resist wrapping stress applied to its surface and its ICM:

- the ICM or added contact plate shall not show significant signs of detachment after the ISO/IEC 7811-2 contact area has been exposed to dynamic wrapping stress. One significant sign of detachment is lifting of at least one corner as a result of exposing the card to wrapping stress.
- The mICC should provide the correct ATR prior and after exposure to the defined stress; if electrical failures occur, they shall only occur at a rate of less than 1%;
- In a Card where the ICM is connected to an antenna inside the card, the Card should continue to provide the correct ATS or ATQ (depending on technology); if during monitoring electrical failures occur, they shall only occur at a rate of less than 1%;
- In an IAC where the ICM is galvanically connected to other components inside the card, this connection should continue to conduct as intended. If a component inside the IAC (but not the antenna) fails due to the wrapping stress, but the ICM remains fully functional, and the Vendor can demonstrate that the connection from the ICM into the card remains conductive as intended, then the failure of the component inside the card shall not be considered a reason for non-conformity of the Card against this requirement.

The Card's robustness against wrapping stress shall be determined by wrapping the card around a cylinder, with a diameter D of 40 mm, 10 cycles contact side up and 10 cycles reverse side up, as defined in the test method, with the Card's end containing the ISO/IEC 7816-2 contact area being located close to the jaws.

ICC Requirements - Requirements applicable to the components ICC, and IAC

General – Requirements applicable to all ICC independent of the interface



Note

While this test might not necessarily destroy the card, it cannot be assumed that a card exposed to this test remains unaffected by it, even if it appears unaffected. It is therefore not recommended to use this test to check large volumes of cards, e.g. as part of an incoming inspection of Card foreseen for personalization and assume these Cards to have the same functionality and reliability as cards that have not undergone this test.



Note

With certain ICC designs, this test might cause localized detachment of the non-conductive adhesive near the connection points of the antenna. If the ICM remains firmly attached in all 4 corners, and this problem only occurs occasionally, then this shall not be considered a failure, if the Card continues to provide the correct ATS or ATQ after exposure to the stress.



Note

Results of the wrapping test have not shown to correlate with electrical failures occurring in the field, neither to identify mechanically sensitive constructions, nor to cause failure modes occurring in the field. While mICC, that is ICC produced from CB and ICM, can generally be expected to pass this test with electrical failure rates of less than 1%, other card constructions might fail this test at a higher rate. If such other card construction shows electrical failures after exposure to the wrapping test, the result of this test shall be considered as inconclusive, and marked as "n/a" in the cqmAP with an added note explaining that the "results are inconclusive, electrical failures occurred with non mICC card construction".

Note that this consideration might change in the future, should additional evidence become known.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (ICM, cavity dimensions, milling and embedding process flow and parameters) produced during the preceding interval, but is not required to consider every different artwork.

Test Method: **#8220#: Mechanical Reliability: Wrapping Test**

11.1.4 #3068#: Wrapping Test Robustness for IAC

CQM Tag	#3068#		
CQM Requirement	11.1.4 #3068#: Wrapping Test Robustness for IAC		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- any Biometric Sensor Module - Any IACIL - Any InterActive Card		
Test Method	#8221#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Month.		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): new, imported from CSI, R-CSI-Bio2.		

ICC Requirements - Requirements applicable to the components ICC, and IAC

General – Requirements applicable to all ICC independent of the interface

A biometric sensor embedded into an IAC shall resist wrapping stress applied to its surface:

- the biometric sensor shall not show significant signs of detachment after the ISO/IEC 7811-2 contact area has been exposed to dynamic wrapping stress. One significant sign of detachment is lifting of at least one corner as a result of exposing the card to wrapping stress.

The Card's robustness against wrapping stress shall be determined by wrapping the card around a cylinder, with a diameter D of 40 mm, 10 cycles contact side up and 10 cycles reverse side up, as defined in the test method, with the Card's end containing the fingerprint sensor being located close to the jaws.

If the Card fails the test using a cylinder with a radius having a diameter of 40 mm, the Vendor shall repeat the test with a cylinder having a diameter of 50 mm and submit both the results obtained with a diameter of 40 mm and those obtained with a diameter of 50 mm to CSI to request a CSI letter.



Note

While this test might not necessarily destroy the card, it cannot be assumed that a card exposed to this test remains unaffected by it, even if it appears unaffected. It is therefore not recommended to use this test to check large volumes of cards, e.g. as part of an incoming inspection of Card foreseen for personalization and assume these Cards to have the same functionality and reliability as cards that have not undergone this test.



Note

With certain ICC designs, this test might cause localized detachment of the non-conductive adhesive near the connection points of the antenna. If the ICM remains firmly attached in all 4 corners, and this problem only occurs occasionally, then this shall not be considered a failure, if the Card continues to provide the correct ATS or ATQ after exposure to the stress.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (card construction, materials, components, manufacturing process flow and parameters) produced during the preceding interval, but is not required to consider every different artwork.

Test Method: **#8220#: Mechanical Reliability: Wrapping Test**

11.1.5 #3056#: IC or ICM

CQM Tag	#3056#		
CQM Requirement	11.1.5 #3056#: IC or ICM		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IC Card		
Test Method	Specification review		
Default CQM Q-Plan:			

ICC Requirements - Requirements applicable to the components ICC, and IAC

General – Requirements applicable to all ICC independent of the interface

CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.
CQM Monitoring	None required

The ICC shall contain at least one IC, typically packaged into an ICM.

Cards that do not contain an IC are not ICC or IAC.

11.1.6 #3057#: 3 wheel Test Robustness for Interactive Cards ("IAC") and ICC made without an ICM

CQM Tag	#3057#		
CQM Requirement	11.1.6 #3057#: 3 wheel Test Robustness for Interactive Cards ("IAC") and ICC made without an ICM		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICC with LED indicating card is exposed to reader field - iacL with RFID indicating LED - Any InterActive Card		
Test Method	#8270#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Month.		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): Test frequency reduced from 1/day to 1/month to synchronise with standard 3 wheel test. Examples for MSA added. Reminder inserted that non-conforming products must receive CSI letter.		
After V2.22	Technical changes (incl. editorial changes): added clarification regarding re-using sample and validity of results obtained using a force higher than the minimum force.		

11.1.6.1 Introduction

This requirement applies to all cards containing IC or other complex electronic devices that are not located behind the ISO 7816-2 contact plate, such as IAC and ICC produced from IL already containing the IC such as pICC.



Note

To improve readability of this requirement, the subsequent text only mentions IAC, but the reader shall understand "IAC" to refer to IAC, and ICC produced using inlays already containing the IC, such as KIL, DIL, PIL.

11.1.6.2 Acronyms and Definitions

IAC	InterActive Card – A card that contains built in devices that allow interaction with the card holder without the help of a card reading device, e.g. push buttons, displays, LEDs, typically but not necessarily containing a battery.
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Display	Display – a device on a card that can display information that can change over time, the content of the information shown being controlled by electronics inside or outside of the card.
MSA	<p>Mechanically Sensitive Area – an area of the card that might be significantly more sensitive to mechanical stress than the plastic card body, an area where local mechanical stress might cause failure of the card.</p> <p>Examples for MSA are:</p> <ul style="list-style-type: none"> ▪ biometric sensor, eg fingerprint sensor ▪ Display or LED ▪ IC embedded inside the card
Horizontal	The direction parallel to the long edges of the card
Vertical	The direction parallel to the short edges of the card

11.1.6.3 Requirement

Every MSA on an IAC shall be robust against local mechanical stress as it typically occurs during processing, personalization, and normal use of the card.

To ensure this, every MSA on the card shall pass the following requirement, unless otherwise specified by a separate requirement:

- 3 wheel test with 8 N force for 2x50 cycles, horizontally and vertically

And every MSA on the card is highly recommended to pass the following requirement, unless otherwise specified by a separate requirement:

- 3 wheel test with 10 N force for 2x50 cycles, horizontally and vertically during monitoring, and
- 3 wheel test with 12 N force for 2x50 cycles, horizontally and vertically during qualification.

If for a certain MSA the vendor has determined during qualification that one direction (horizontal or vertical) is the direction where the MSA is constantly weaker, the vendor may reduce monitoring of the MSA to the weaker direction.

The vendor shall retain test results, including those for the recommended forces, and make them available to Mastercard upon request.

The vendor may use different samples for testing in horizontal and vertical direction (but always the same sample for front and backside in one direction), or may re-use the samples from one direction for the other direction.

The vendor may use different samples for testing at different forces, or may re-use the samples from testing at a lower force.

Conforming results from a higher force than the minimum required may be used to demonstrate conformity with the minimum required force. For example, if the minimum

ICC Requirements - Requirements applicable to the components ICC, and IAC

General – Requirements applicable to all ICC independent of the interface

required force is 8 N, vendor tests samples only at 12 N, and the samples pass the test, then this result shall be accepted as evidence that the samples comply with the requirement at the minimum required force of 8 N.



Note

2 x 50 cycles refers to the 50 cycles front side up and 50 cycles front side down as defined in #8270#: Advanced 3 wheel Test



Note

IAC not compliant with this requirement must be subjected to Mastercard's CSI process, and receive a CSI letter before issuance is permitted.

Test Method: **#8270#: Advanced 3 wheel Test**

11.1.7 #3066#: Resistance of a Display to Local Impact for Interactive Cards ("IAC")

CQM Tag	#3066#		
CQM Requirement	11.1.7 #3066#: Resistance of a Display to Local Impact for Interactive Cards ("IAC")		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IAC with a Display		
Test Method	#8280#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Month.		

An IAC containing a display shall remain fully functional after exposure to the test method **13.2.1.38 #8280#: Resistance of a Display to Local Impact**.

11.1.8 #2039#: Fingerprint Sensor – Pressure Test

CQM Tag	#2039#		
CQM Requirement	11.1.8 #2039#: Fingerprint Sensor – Pressure Test		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IAC with Fingerprint Sensor		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 10		
CQM Monitoring	10 items every Year.		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): New. Imported from CSI, R-CSI-Bio5.		
After V2.22	Editorial changes only: reworded to improve understanding		

ICC Requirements - Requirements applicable to the components ICC, and IAC
General – Requirements applicable to all ICC independent of the interface

A biometric sensor implemented into an IAC shall remain compliant with **#2043#:** **Functional Verification of Biometric Sensors** after exposure to pressure with a force of 10N for 1 cycle, and should remain compliant after exposure to pressure of 12N, 15N, 20N, and 25N for 1 cycle each, according to the test method **#8290#:** **Resistance of a Fingerprint Sensor against Pressure**. 2 Samples each shall be exposed to the Pressure Test at each force as outlined in the below table:

Sample Set		1 st Exposure
#	Number of samples	Samples shall pass this exposure
1	2	1 cycle × 10 N
2	2	1 cycle × 12 N
3	2	1 cycle × 15 N
4	2	1 cycle × 20 N
5	2	1 cycle × 25 N

The Vendor shall report the results for for each individual sample.

The vendor shall retain test results, including those for the recommended forces, and make them available to Mastercard upon request.

Test method: **#8290#:** **Resistance of a Fingerprint Sensor against Pressure**

11.1.9 #2040#: Fingerprint Sensor – Service Life

CQM Tag	#2040#		
CQM Requirement	11.1.9 #2040#: Fingerprint Sensor – Service Life		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IAC with Fingerprint Sensor		
Test Method	#8291#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): New. Imported from CSI, R-CSI-Bio6.		

A biometric sensor implemented into an IAC shall remain compliant with **#2043#:** **Functional Verification of Biometric Sensors** after exposure to 1200 pressure cycles with a force of 9N, and should remain compliant after exposure to 1200 additional cycles with a force of 15N according to the test method defined below.

ICC Requirements - Requirements applicable to the components ICC, and IAC
General – Requirements applicable to all ICC independent of the interface

In addition, the Vendor shall determine and report how many additional intervals of 1200 additional cycles at 15N the card survives, at least up to a maximum of 12000 cycles.

The vendor shall retain test results, including those for the additional intervals, and make them available to Mastercard upon request.

Test method: **#8291#: Resistance of a Fingerprint Sensor against repeated Pressure**

11.1.10 #2041#: Fingerprint Sensor – Resistance to Abrasion

CQM Tag	#2041#		
CQM Requirement	11.1.10 #2041#: Fingerprint Sensor – Resistance to Abrasion		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IAC with Fingerprint Sensor		
Test Method	#8300#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	8 items every Year.		
Changelog:			
After V2.19.1	New: Imported from CSI, R-CSI-Bio7.		
After V2.22	Technical changes (incl. editorial changes): Number of abrasion cycles defined as 120		

A biometric sensor implemented into an IAC shall remain compliant with **#2043#: Functional Verification of Biometric Sensors** after exposure to 120 abrasion cycles according to the test method defined below:

Test method: **#8300#: Resistance of a Fingerprint Sensor against Abrasion**

The Vendor may use alternative methods. In this case the Vendor shall make the results available to Mastercard upon request.

11.1.11 #2042#: Fingerprint Sensor – Resistance to Scratching

CQM Tag	#2042#		
CQM Requirement	11.1.11 #2042#: Fingerprint Sensor – Resistance to Scratching		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Biometric Sensor Module with a Fingerprint Sensor - IAC with Fingerprint Sensor		
Test Method	#8310#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 6		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	New: Imported from CSI, R-CSI-Bio8.		

ICC Requirements - Requirements applicable to the components ICC, and IAC
General – Requirements applicable to all ICC independent of the interface

A biometric sensor implemented into an IAC shall remain compliant with **#2043#**: **Functional Verification of Biometric Sensors** after exposure to 1 linear scratch with a 5H pencil according to the test method defined below:

Test method: **#8310#**: **Resistance of a Fingerprint Sensor against Scratching**

If the IAC Vendor can provide qualification results from the BSM Vendor, then the IAC Vendor is not required to repeat the test, and may use the results provided by the BMS Vendor instead.

11.1.12 #2043#: Functional Verification of Biometric Sensors

CQM Tag	#2043#		
CQM Requirement	11.1.12 #2043#: Functional Verification of Biometric Sensors		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- any Biometric Sensor Module - Any IACIL - Any InterActive Card		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	100% control required		
Changelog:			
After V2.19.1	New: Imported from CSI R-CSI-Bio4. Added that such functional verification shall not require the use of a real or simulated biometric credentials.		

The Vendor of an iacICM, an iacIL, and an IAC, shall ensure its biometric functionality, and the interconnection of its components, can be verified sufficiently by implementing and documenting adequate testing functionality, and making this information available to the Vendors utilizing these components.



Note

Testing of biometric functionality may be restricted by the life cycle stage the CHD or CQM Component is in. This should be considered when designing the QCP and during CQM assessment.

The minimum Functional Verification of Biometric Sensors shall include a sensor self-test, and, once an interconnection between the Biometric Sensor and other electronic devices inside the CHD has been established, verification that this interconnection is operating as intended.

CQM recommends the use of Built-In Self-Test ("BIST") functions to verify the functionality of the biometric functionality without requiring the actual presentation of biometric credentials to the sensor. This requirement #2043# shall not be interpreted as if it were requiring presentation of biometric credentials during the verification of biometric functionality.

ICC Requirements - Requirements applicable to the components ICC, and IAC

General – Requirements applicable to all ICC independent of the interface

Vendors producing iacICM or iacIL shall ensure that the biometric functionality operates as intended before shipping the iacICM or iacIL to an IAC Vendor.

Vendors implementing iacICM or iacIL into an IAC and personalizing the IAC themselves shall ensure that the biometric functionality operates as intended before forwarding the IAC to the issuer or cardholder.

Vendors implementing iacICM or iacIL into an IAC forwarding it to a personalizer shall ensure that the biometric functionality operates as intended before shipping the IAC to the personalizer.

Vendors personalizing IAC shall ensure that the biometric functionality operates as intended before shipping the IAC to the cardholder or the issuer.

11.1.13 #2044#: Functional Verification of Additional Functionality

CQM Tag	#2044#		
CQM Requirement	11.1.13 #2044#: Functional Verification of Additional Functionality		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any IACICM Activity - any Biometric Sensor Module - Any IACIL - Any InterActive Card		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	100% control required		
Changelog:			
After V2.19.1	New		

The Vendor of a CHD or CQM Component containing functionality that is in addition to contact, contactless, and biometric functionality, shall ensure that such Additional Functionality functions as intended before providing the CHD to a cardholder or issuer, or the CQM Component to a subsequent Vendor, if the Additional Functionality could reasonably be associated by the cardholder with the payment functionality, for example a LED that lights up when a transaction takes place.

If the Additional Functionality can be reasonably associated with the payment process, then the additional feature shall remain functional during the expected life of the CHD, and after testing required by this document where verification of functionality of the CHD is required.

If the Additional Functionality cannot be reasonably associated with payment, eg a LED that functions like a mini torch, or a CHD that plays a song upon press of a button not directly related to the payment process, then the Additional Functionality is outside of the scope of the CQM Requirement and the related assessment processes.



Note

Vendors should note that considering certain Additional Functionality outside of the scope of the CQM Requirements in this document does not absolve them from having to fulfil contractual requirements established between the Vendor and their customers regarding the proper function of such Additional Functionality.

11.2 Contact – Requirements applicable to ICC having a contact interface

11.2.1 #3058#: Solidity – Adhesion of ICM to Card

CQM Tag	#3058#		
CQM Requirement	11.2.1 #3058#: Solidity – Adhesion of ICM to Card		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC Card produced using an ICM containing the IC - IAC produced using an ICM containing the IC		
Test Method	#8230#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

The adhesive between ICM and CB is a key factor of the ICC's durability and is designed to bond plastic and other materials (CB and ICM substrate). Many variables – ranging from physical properties of the related substrates, process parameters to end use environment – can affect the adhesion.

The force necessary to separate the ICM, or an added contact plate in the ISO/IEC 7816-2 contact location, from the card shall be at least 50 N for ICM with an Area of up to 100 mm², and at least 0.5 N/mm² for ICM with an Area of more than 100 mm². For modules of an Area of more than 200 mm², a result of at least 100 N shall be deemed compliant.

The force necessary to rupture an ICM that has not separated from the ICC during the test shall be at least 30 N, provided the ICM remains attached to the ICC in all 4 corners of the ICM. The area of the ICM or added contact plate is the punched size of the ICM, not just the metallized area, nor just the adhesive area.

The area of the ICM shall be the size of the ICM or added contact plate as it is punched out from the ICM tape prior to implanting. Radii at the corners of the ICM may be considered when calculating the Area of the ICM.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall take into account the different card constructions (layers, materials, ICM, process flow and parameters) produced during the preceding interval, but is not required to take into account every different artwork.



Note

This requirement does not apply to other components of IAC, such as displays or biometric sensors.

Test Method: **#8230#: Solidity – ICM Adhesion – Back of Card Spot Pressure Test**

11.2.2#3059#: Relative Height of Contacts

CQM Tag	#3059#		
CQM Requirement	11.2.2 #3059#: Relative Height of Contacts		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC Card having a Contact Interface - IAC having a Contact Interface		
Test Method	#8010#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up, recheck required each 1000 items produced.		

No point of the ICM surface, or the surface of an added contact plate, shall be more than 0.05 mm above the adjacent surface of the card, and no point of the ICM surface shall be more than 0.10 mm below the adjacent surface of the card.

In case there is no ICM nor an added contact plate, no point of the entire surface of the ISO/IEC 7816-2 contacts (and not just the minimum contact areas) shall be more than 0.05 mm above the adjacent surface of the card, and no point of the ICM surface shall be more than 0.10 mm below the adjacent surface of the card. Any card surface that cannot be reasonably considered part of an ISO/IEC 7816-2 contact but lies within the perimeter created by the ISO/IEC 7816-2 minimum contact areas C1, C4, C5, and C8 shall comply with **#3004#: Thickness within Add-on Areas**.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (layers, materials, ICM, process flow and parameters) produced during the preceding interval but is not required to take into account every different artwork.

Test Method: **#8010#: Relative Height of Contacts**

11.2.3#3060#: Location of Contacts

CQM Tag	#3060#		
CQM Requirement	11.2.3 #3060#: Location of Contacts		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- IC Card having a Contact Interface - IAC having a Contact Interface		
Test Method	#8020#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 50		
CQM Monitoring	1 item every Set-up, recheck required each 1000 items produced.		

The location of contacts exposed on the surface of ICC shall comply with ISO/IEC 7816-2.

Test Method: **#8020#: Dimension and Location of Contacts**

For ICC vendors, a template overlay showing the Minimum Contact Areas is highly recommended to allow the efficient checking of larger numbers of cards.

CQM considers the result of the test being independent of the artwork. Conclusively the sampling for this test shall consider the different card constructions (layers, materials, ICM, process flow and parameters) produced during the preceding interval, but is not required to consider every different artwork.

11.3 Contactless – Requirements applicable to ICC having a contactless interface

11.3.1 #3061#: Verification of Antenna Functionality, and Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")

CQM Tag	#3061#		
CQM Requirement	11.3.1 #3061#: Verification of Antenna Functionality, and Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM including ISO/IEC 14443 Antenna - Inlay with an antenna and an IC, but no 7816-2 contacts - IC Card having a Contactless Interface - IAC/ICM including ISO/IEC 14443 Antenna - Inlay with an antenna and an IC, but no 7816-2 contacts - IAC having a Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	100% control required		

If an ICC contains an antenna connected to the IC hosting the Mastercard related payment application, it is a ICC.

If an IAC contains an antenna connected to the IC hosting the Mastercard related payment application, it is a DIAC or PIAC.

If an IL contains an antenna connected to an IC hosting the Mastercard related payment application, it is a PIL.

The PIL or card shall comply with **5.3.17 #2035#: Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")**.

Conducting a more complex communication with the card to verify its function, e.g. one that includes a write to non-volatile memory, is recommended. Verifying the contactless function of the card at a distance determined in accordance with **#3064#: Reading Distance** is recommended, instead of testing at a shorter, more ideal distance, to enable identifying cards with a reduced reading distance.

The antenna shall conform to the requirements specified by the IC Vendor for the relevant IC.

The antenna shall be designed considering the dielectric characteristics of the CB material as laminated by the CB provider.

The vendor shall test the electromagnetic system once the IC or ICM is connected to the antenna and the complete electromagnetic system is available and prior to personalization or shipping the PIL or ICC, or IAC to a client or card holder.

11.3.2 #3062#: Resonance Frequency

CQM Tag	#3062#		
CQM Requirement	11.3.2 #3062#: Resonance Frequency		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<div>- ICM including ISO/IEC 14443 Antenna</div> <div>- Inlay with an antenna and an IC, but no 7816-2 contacts</div> <div>- IC Card having a Contactless Interface</div> <div>- IACICM including ISO/IEC 14443 Antenna</div> <div>- Inlay with an antenna and an IC, but no 7816-2 contacts</div> <div>- IAC having a Contactless Interface</div>		
Test Method	#6023# #6024#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	2 items every Batch.		

Resonance frequency and full contactless functionality shall be tested before shipping the card to subsequent processing.

The following parameters shall be tested:

- For a Card Vendor's card product, the range of the resonance frequency of the items produced shall be less than ± 800 kHz around the nominal value defined by the provider of the PIL, AIL, or IC, as applicable.
- Over volume production the Vendor shall ensure the resonance frequency remains close to the resonance frequency of the samples approved through the applicable type approval process. The vendor shall determine the average, range and standard deviation of the qualification lot from which the samples were sent to the applicable type approval process. The vendor shall ensure the products produced in volume remain both within the range, and the (average ± 4 times the standard deviation), of the functional samples of the qualification lot from which samples were sent to the applicable type approval process. This resonance frequency should be measured using an electromagnetic field corresponding to nominal supply of the ICC (e.g. as in Test method defined in [EMVL] clause 3.2.2 "pICC Requirements for Power Transfer PCD to pICC" under the conditions $F_{S,C} = \text{Nom}$, $V_{S,OV} = \text{Nom}$, ICC placed at ($r=0$, $\phi=0$, $z=2$ cm, $\theta=0$, or e.g. 4 A/m). The Vendor shall define the exact test conditions of the Vendor's controls including the field strength, and maintain these test conditions within reasonable tolerances.
- PIL: When sandwiched in the test assemblies as specified by the PIL provider, the resonance frequency of the inlay shall not shift by more than 700 kHz
- The Vendor is permitted to use suitable test equipment compliant with ISO/IEC 10373-6 for this measurement.



Note

The term 'Standard Deviation' can identify two different values, the Sample Standard Deviation, and the Population Standard Deviation.
 For the purpose of this document, always use the Sample Standard Deviation, commonly identified by the letter 's' and calculated as follows:

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n - 1}}$$

Where: x_i is a measurement value with i counting from 1 to n , \bar{x} is the arithmetic average of the n measurements, n is the number of samples measured.

If any of the tested samples does not conform with the requirement, the entire batch shall be (re-)tested with a sampling rate of 100%.

It is recommended, especially during the initial production runs of a new product, to test with a higher sampling rate of at least 20 samples per batch.

11.3.3#3063#: Q-Factor

CQM Tag	#3063#		
CQM Requirement	11.3.3 #3063#: Q-Factor		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<div>- ICM including ISO/IEC 14443 Antenna</div> <div>- Inlay with an antenna and an IC, but no 7816-2 contacts</div> <div>- IC Card having a Contactless Interface</div> <div>- IACICM including ISO/IEC 14443 Antenna</div> <div>- Inlay with an antenna and an IC, but no 7816-2 contacts</div> <div>- IAC having a Contactless Interface</div>		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	2 items every Batch.		

The lamination process and possibly other production processes affect the Q-Factor and consequently the Q-Factor will only obtain its final value in the ICC.

The Vendor shall demonstrate that the Q-Factor is stable over the production volume and is controlled in the production process. The Q-Factor should be considered 'stable' if it remains within the average value of the functional samples of the qualification lot ± 4 times the standard deviation.

ICC Requirements - Requirements applicable to the components ICC, and IAC

Contactless – Requirements applicable to ICC having a contactless interface



Note

The term 'Standard Deviation' can identify two different values, the Sample Standard Deviation, and the Population Standard Deviation.
For the purpose of this document, always use the Sample Standard Deviation, commonly identified by the letter 's' and calculated as follows:

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n - 1}}$$

Where: x_i is a measurement value with i counting from 1 to n , \bar{x} is the arithmetic average of the n measurements, n is the number of samples measured.

If any of the tested samples does not conform with the requirement, the entire batch shall be (re-)tested with a sampling rate of 100%.

See #3062# for information related to test conditions and test equipment.



Note

The Q-Factor characterizes the antenna's bandwidth relative to its resonance frequency. The Q-Factor is the frequency to bandwidth ratio of the antenna. A higher Q-Factor means that the antenna responds stronger to its resonance frequency and weaker to a frequency different than its resonance frequency than an antenna with a lower Q-Factor.



Note

The name "Q-Factor" was chosen because the letter Q was conveniently available when K.S. Johnson created the term while evaluating coils. "Q-Factor" is not a short form of "Quality-Factor", though in some cases the two terms are synonymous.

It is recommended, especially during the initial production runs of a new product, to test with a higher sampling rate of at least 20 samples per batch.

11.3.4 #3064#: Reading Distance

CQM Tag	#3064#		
CQM Requirement	11.3.4 #3064#: Reading Distance		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<ul style="list-style-type: none">- ICM including ISO/IEC 14443 Antenna- Inlay with an antenna and an IC, but no 7816-2 contacts- IC Card having a Contactless Interface- IACICM including ISO/IEC 14443 Antenna- Inlay with an antenna and an IC, but no 7816-2 contacts- IAC having a Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	3 items every Batch.		

'Reading Distance' is the maximum distance between the card's and a certain reader's antenna at which the card can be operated correctly and reliably. 'Reading Distance' may be different for every combination of card and reader type.

The vendor shall ensure conformity with this requirement at two stages:

- Stage 1 – Qualification
- Stage 2 – Production Monitoring

Conformity with this requirement may be ensured by either:

- verifying during qualification and production monitoring the products conform with:
 - **#2025#: Carrier Frequency – Operational Range** , and
 - **#2026#: Carrier Amplitude – Operational Range** ;

or by establishing a vendor internal reference for production monitoring using a specific reader system²⁰ the Vendor chooses as a 'Vendor internal reference reader'.

CQM permits two different approaches to monitor Reading Distance:

- Varying and measuring the distance between the card and the reader by keeping the antenna current of the reader constant; and
- Varying and measuring the antenna current of the reader while keeping the card in a defined and fixed position.

11.3.4.1 Approach 1 – Minimum Reading Distance

11.3.4.1.1 Stage 1 – Qualification

During Qualification the Vendor shall ensure that all samples from the Qualification lot comply with:

- **#2025#: Carrier Frequency – Operational Range** , and
- **#2026#: Carrier Amplitude – Operational Range**.

Unless the Vendor monitors conformity with #2025# and #2026# during production, the Vendor shall during qualification of a specific PIL, ICC product determine the 'Reading Distance Minimum' for a specific reader system the Vendor chooses as a 'Vendor internal reference reader'.



Note

The qualification lot is the lot from which cards are submitted to the contactless card approval process mandated by Mastercard.

To determine the Reading Distance Minimum, the vendor shall select the required number of samples, typically from the Qualification Lot, that comply with the following requirements:

- **#2025#: Carrier Frequency – Operational Range** , and

²⁰ "specific reader system" comprises a specific reader, specific settings of the reader, and a specific mechanism to position the card relative to the reader

▪ **#2026#: Carrier Amplitude – Operational Range.**

The vendor shall then determine the Reading Distance of each of the selected samples with the Vendor internal reference reader and calculate the Reading Distance Minimum.

The Reading Distance Minimum RD_{min} is:

$$RD_{min} = 0.9 \times (\bar{x} - 3 \times s)$$

of the measured Reading Distance values between the samples from the qualification lot and the Vendor internal reference reader, where \bar{x} is the arithmetic average of the measured reading distance values and s is the Sample Standard Deviation of the measured reading distance values.



Note

The term 'Standard Deviation' can identify two different values, the Sample Standard Deviation, and the Population Standard Deviation.

For the purpose of this document, always use the Sample Standard Deviation, commonly identified by the letter 's' and calculated as follows:

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n - 1}}$$

Where: x_i is a measurement value with i counting from 1 to n , \bar{x} is the arithmetic average of the n measurements, n is the number of samples measured.

Alternatively, as the basis for Production Monitoring, the vendor may use as the Reading Distance Minimum RD_{min} the (maximum) Reading Distance of a card with the Vendor internal reference reader, provided that card passes both #2025# and #2026#. To determine the Reading Distance Minimum, the vendor shall:

- Verify the card complies with #2025# and #2026#,
- Make at least 5 measurements of the (maximum) Reading Distance the card functions using the Vendor internal reference reader,
- Discard the highest and the lowest of the measurements, and
- calculate the average of the remaining measurements, called RD in the following formula, and

calculate the Reading Distance Minimum RD_{min} : $RD_{min} = 0.9 \times RD$



Note

If the vendor is procuring inlay and/or ICM and is re-using the inlay, ICM or IC vendor's LoA or CCS under the vendor's CVCS, then the vendor might not have access to cards from the qualification lot. In such case the vendor should request reference samples from their supplier.

11.3.4.1.2 Stage 2 – Production Monitoring

During volume production the Vendor shall monitor that products function as intended at a certain distance from a contactless card reader.

To monitor this, the vendor can either during volume production verify conformity with:

- **#2025#: Carrier Frequency – Operational Range** and
- **#2026#: Carrier Amplitude – Operational Range** ;

or during volume production verify that the cards produced function as intended at the Reading Distance Minimum RD_{min} with the Vendor internal reference reader.

To check the function of the card, at least a successful ATS (Answer to Select) sequence shall be conducted.

Some recent IC designs only power on a small part of the IC's circuitry if the card is only required to provide an ATS or an ATQ, and parts of the IC required for higher functionality, like cryptographic functionality or writing to non-volatile memory, remain powered off. This can lead to false assumptions regarding the maximum reading distance a card might still function at. To ensure such false assumptions are avoided, verification of compliance with this requirement shall include use of such higher functionality, for example invoking a cryptographic function or writing to non-volatile memory.

In certain cases, eg due to security restrictions of not-yet-personalized cards, it may not be possible to invoke functionality beyond ATS or ATQ during test. In this case it is necessary to monitor the ATS or ATQ timing, taking into account the behavior that a card receiving insufficient power while operating contactless is more likely to request lower bit-rates and repetition of the whole or part of the communication sequence leading to its ATS or ATQ response. To achieve this the vendor shall determine the standard distribution (average and standard deviation) for the card's ATS or ATQ from the qualification lot, and verify during volume production that the timing of the cards falls into the typical range of (average $\pm 3 \cdot$ standard deviation).

11.3.4.2 Approach 2 – Minimum Reading Current

Instead of varying the actual distance between the card and the reader, it is permitted that the field strength of the reader verifying the Minimum Reading Distance check is adjusted to simulate a change in distance by controlling the current flowing through the antenna. This may be found useful where the test antenna is installed in automated manufacturing equipment and modifying the distance between the card and the reader might be impractical.

'Reading Current' is the minimum antenna current powering a reader's antenna at which the card can be operated correctly and reliably in a defined position relative to the reader.

'Reading Current' may be different for every combination of card and reader type and card position.

The vendor shall ensure conformity with this requirement at two stages:

- Stage 1 – Qualification
- Stage 2 – Production Monitoring

Conformity with this requirement may be ensured by either:

- verifying during qualification and production monitoring the products conform with:
 - **#2025#: Carrier Frequency – Operational Range** , and
 - **#2026#: Carrier Amplitude – Operational Range** ;

or by establishing a vendor internal reference for production monitoring using a specific reader system the Vendor chooses as a 'Vendor internal reference reader'.

11.3.4.2.1 Stage 1 – Qualification

During Qualification the Vendor shall ensure that all samples from the Qualification lot comply with:

- **#2025#: Carrier Frequency – Operational Range** , and
- **#2026#: Carrier Amplitude – Operational Range**.

Unless the Vendor monitors conformity with #2025# and #2026# during production, the Vendor shall during qualification of a specific PIL, ICC product determine the 'Reading Current Minimum' for a specific reader system the Vendor chooses as a 'Vendor internal reference reader'.



Note

The qualification lot is the lot from which cards are submitted to the contactless card approval process mandated by Mastercard.

To determine the Reading Current Minimum RI_{min} , the vendor shall select the required number of samples, typically from the Qualification Lot, that comply with the following requirements:

- **#2025#: Carrier Frequency – Operational Range** , and
- **#2026#: Carrier Amplitude – Operational Range**.

The vendor shall then determine the Reading Current of each of the selected samples with the Vendor internal reference reader and calculate the Reading Current Minimum.

The Reading Current Minimum RI_{min} is:

$$RI_{min} = 1.1 \times (\bar{x} + 3 \times s)$$

of the measured Reading Current values of the samples from the qualification lot and the Vendor internal reference reader, where \bar{x} is the arithmetic average of the measured

Reading Current values and s is the Sample Standard Deviation of the measured Reading Current values.



Note

The term 'Standard Deviation' can identify two different values, the Sample Standard Deviation, and the Population Standard Deviation.
For the purpose of this document, always use the Sample Standard Deviation, commonly identified by the letter 's' and calculated as follows:

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$

Where: x_i is a measurement value with i counting from 1 to n , \bar{x} is the arithmetic average of the n measurements, n is the number of samples measured.

Alternatively, as the basis for Production Monitoring, the vendor may use as the Reading Current Minimum the (minimum) Reading Current of a card with the Vendor internal reference reader, provided the card passes both #2025# and #2026#. To determine the Reading Current Minimum, the vendor shall:

- Verify the card complies with #2025# and #2026#,
- Make at least 5 measurements of the (minimum) Reading Current using the Vendor internal reference reader,
- Discard the highest and the lowest of the measurements, and
- calculate the average of the remaining measurements, called RI in the following formula, and

calculate the Reading Current Minimum RI_{min} : $RI_{min} = 1.1 \times RI$



Note

If the vendor is procuring inlay and/or ICM and is re-using the inlay, ICM or IC vendor's LoA or CCS under the vendor's CVCS, then the vendor might not have access to cards from the qualification lot. In such case the vendor should request reference samples from their supplier.

11.3.4.2.2 Stage 2 – Production Monitoring

During volume production the Vendor shall monitor that products function as intended at a certain distance from a contactless card reader.

To monitor this, the vendor can either during volume production verify conformity with:

- **#2025#: Carrier Frequency – Operational Range** and
- **#2026#: Carrier Amplitude – Operational Range** ;

or during volume production verify that the cards produced function as intended at the Reading Current Minimum RI_{min} with the Vendor internal reference reader.



Note

Writing to non-volatile memory may require a higher antenna current compared to that necessary for a successful ATS sequence, as the card might have a higher current consumption for such write function than for simply providing an ATS.

12 IL – Requirements for inlays

This chapter defines the Product Requirements applicable to the component IL and, some of which are also applicable to ICC, and IAC.

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12.1 General – Requirements applicable to all IL

12.1.1 #2801#: IL – Construction and Specification

CQM Tag	#2801#		
CQM Requirement	12.1.1 #2801#: IL – Construction and Specification		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Any Inlay Activity - Any IACIL - IAC having a Contactless Interface		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The KIL/DIL/PIL/ ("Contact-Inlay", "Dual-Interface Inlay", "Proximity Inlay") shall be produced by combining the IC or ICM, the antenna and additional layers of typically plastic material and optionally adhesives.

The KIL/DIL/PIL/ shall contain at least one IC. iCs may be implemented as ICM or as bare IC into the PIL.

An inlay that does not contain an IC is not considered a KIL/DIL/PIL/ but an AIL ("Antenna Inlay").

The AIL shall be produced by combining the antenna and additional layers of typically plastic material and optionally adhesives.

The construction of a KIL/DIL/PIL/ shall be well defined and documented, including:

- IC type
- ICM type
- Location of the IC or ICM inside the inlay
- Plastic materials and adhesives used
- Antenna material and geometry
- Technology and materials used to establish the interconnection between IC or ICM and antenna
- Manufacturing processes and parameters (explicitly in the specification or by reference to documents defining the processes)
- Test Processes and Criteria (explicitly or by reference e.g. to a Quality Control Plan)
- Qualification Criteria (explicitly or by reference e.g. to a Qualification Plan)
- Guidance and restrictions for processes and materials to produce cards based on the specified PIL, e.g.
 - Permitted positioning tolerances for the inlay inside a card

- recommended use of specific plastics and/or adhesives to achieve adequate adhesion between the inlay and other card layers
- known restrictions on processing parameters, e.g. temperature and pressure limits for the lamination process
- restrictions regarding the use of metallic inks or other layers that might affect the electromagnetic performance of the PIL.
- Restrictions regarding the positioning of mechanical personalization, e.g. indent print and embossing.

The construction of an AIL shall be well defined and documented, including:

- Plastic materials and adhesives used
- Antenna material and geometry
- IC and ICM compatible with the AIL
- Technology and materials recommended to establish the interconnection between IC or ICM and antenna
- Manufacturing processes and parameters (explicitly in the specification or by reference to documents defining the processes)
- Test Processes and Criteria (explicitly or by reference e.g. to a Quality Control Plan)
- Qualification Criteria (explicitly or by reference e.g. to a Qualification Plan)
- Guidance and restrictions for processes and materials to produce cards based on the specified AIL, e.g.
 - Permitted positioning tolerances for the inlay inside a card
 - Permitted positioning tolerances for the ICM inside the card to ensure proper interconnecting between the ICM and the inlay
 - Recommended use of specific plastics and/or adhesives for the card construction to achieve adequate adhesion between the inlay and other card layers
 - Known restrictions on lamination parameters, e.g. maximum temperature limit
 - Restrictions regarding the use of metallic inks or other layers in the card construction that might affect the electromagnetic performance of the PIL.
 - Restrictions regarding the positioning of mechanical personalization, e.g. indent print and embossing.

The vendor shall specify the construction of the PIL or AIL and document the specification. Examples for acceptable forms for a specification are written documents, tables listing requirements and product details, and parts lists in ERP systems.



Note

The inlay vendor may not want to disclose parts of the specification of the inlay to their customers (e.g. materials and process details of the inlay production process), while other parts required here might be intended for disclosure to the customer (e.g. guidance and restrictions when making a card from the inlay). In such case CQM recommends a modular approach where the internal specification (which may be subject to assessment during the audit) refers to the more public components, such as the guidance document for the customer.

Test Method: no test method.

12.1.2 #2802#: IL – Antenna design and electromagnetic performance

CQM Tag	#2802#		
CQM Requirement	12.1.2 #2802#: IL – Antenna design and electromagnetic performance		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM including ISO/IEC 14443 Antenna - Inlay with an antenna, but no IC - IAC/ICM including ISO/IEC 14443 Antenna - Inlay with an antenna, but no IC - Inlay with an antenna and an IC, but no 7816-2 contacts - IAC having a Contactless Interface		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 70		
CQM Monitoring	3 items every Batch.		

The IL shall contain an antenna.

The antenna shall conform to the requirements specified by the IC Vendor for the IC.

The antenna shall be designed considering the dielectric characteristics of the inlay material, the material of the printed sheets that the ICC Vendor will laminate onto the inlay, and any other material that will become part of the finished ICC, such as inks with a high metallic content or metallic areas inserted into or applied onto the card for design purposes.

The IL Vendor shall control production quality and components such that Resonance Frequency and Q-Factor for the produced volume are well within their specified tolerance ranges. 'Well within their specified ranges' requires that the range defined by the mean value ± 3 times the standard deviation is within the specified tolerance range, assuming a gaussian distribution.

For PIL, the IL Vendor shall test the assembled electromagnetic system as soon as the IC is connected to the antenna, and following any process step that may significantly change the electromagnetic performance, such as lamination, and after adding to or removing any significant amounts of material from the inlay that may change the electromagnetic behavior of the electromagnetic system.

For AIL the IL Vendor shall develop an equivalent testing regime to ensure that the AIL, once connected to the IC, performs well within the specified tolerance ranges. The details depend on the IC and/or ICM and the intended interconnection technology.

If interim products or components, e.g. the PIL, have a resonance frequency outside of the tolerance range permitted for the ICC, the Vendor shall determine and demonstrate the correlation between the values obtained from the interim product or component and the final product, e.g. the pICC.

Test Methods:

- #6023#: Operational Carrier Frequency
- #6024#: Operational Carrier Amplitude

12.1.3 #2803#: IL Thickness

CQM Tag	#2803#		
CQM Requirement	12.1.3 #2803#: IL Thickness		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Inlay with an antenna, but no IC - Inlay with an antenna, but no IC		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 200		
CQM Monitoring	8 items every Batch, recheck required each 100 items produced.		

The thickness of the IL (T_{max}) shall not exceed 500 μm .

In addition, the thickness of an individual IL (T_{IL}) shall not deviate by more than 10 % from the thickness specified by the IL supplier for this type of IL (T_{nom}).



Note

The 'item' in the Q-Plan is the 'sheet', which usually contains multiple card positions. The 'item' is not the individual card position, unless the sheet contains only a single antenna.

12.1.4 #2804#: Antenna Location in IL, ICC, and IAC

CQM Tag	#2804#		
CQM Requirement	12.1.4 #2804#: Antenna Location in IL, ICC, and IAC		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM including ISO/IEC 14443 Antenna - Inlay with an antenna, but no IC - IC Card having a Contactless Interface - IACICM including ISO/IEC 14443 Antenna - Inlay with an antenna, but no IC - Inlay with an antenna and an IC, but no 7816-2 contacts - IAC having a Contactless Interface		
Test Method	Specification review		

Default CQM Q-Plan:	
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.
CQM Monitoring	None required

Antennas shall not interfere adversely with other elements of the card, such as personalization and security elements.

To minimize such risk, the antenna design shall meet the specifications listed below:

- ISO/IEC 7810 and ISO/IEC 7811-1, 14443-1
- [CDS]

Test method: No method is defined here. The Vendor shall consider these requirements when designing the product and check them during qualification and report conformity in the qualification report.

12.1.5 #2805#: Antenna Design – Minimum distance between mechanical personalization areas and the antenna in IL, ICC, IAC

CQM Tag	#2805#		
CQM Requirement	12.1.5 #2805#: Antenna Design – Minimum distance between mechanical personalization areas and the antenna in IL, ICC, IAC		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<ul style="list-style-type: none">- ICM including ISO/IEC 14443 Antenna- Inlay with an antenna, but no IC- IC Card having a Contactless Interface- IACICM including ISO/IEC 14443 Antenna- Inlay with an antenna, but no IC- Inlay with an antenna and an IC, but no 7816-2 contacts- IAC having a Contactless Interface		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		
Changelog:			
After V2.22	Technical changes (incl. editorial changes): adjustments for IAC and revised wording		

Mastercard prohibits embossing and indent printing over a wire embedded antenna and other embedded component that might be damaged by such personalization method.

The distance d from any part of the antenna or other embedded component to any embossed or indent printed character shall be $d > 0.5$ mm.

Design of the IL and ICC shall allow for manufacturing tolerances such, that the above minimal distance is guaranteed.

Any restrictions to the placement of graphical personalization on the surface of the card that the personalizer shall respect to prevent damage to the antenna or other embedded

component shall be specified by the IL and card vendors as "Personalization Restrictions" and these Personalization Restrictions shall be communicated to the personaliser.



Note

CQM suggests the following approach to sufficiently specify the Personalization Restrictions:

- Create a drawing of the card, specify the areas where the card can, or cannot be embossed, with dimensions. For example add a green rectangle to indicate the area where the card can be embossed.
- Add an explanation, for example "This card can only be embossed in the green area."
- Include the drawing and the explanation in the specification of the IL or card construction.
- Ensure that these Personalization Restrictions are communicated to the customer and personaliser, and in the case of IL, to the card manufacturer processing the IL into a card. This can be done for example via a datasheet, or by including the Personalization Restrictions information in the PDF typically used to approve the artwork.

If the IL or card does not comply with this requirement, or if the IL or card Vendor fails to demonstrate conformity to this requirement, then:

- The IL vendor shall demonstrate compliance with **#2806#: Antenna Design non-compliant with #2805# – IL Embossability**
- The card vendor shall demonstrate compliance with **#2807#: Antenna Design non-compliant with #2805# – Card Embossability**

See **#BE00# Verification of contactless functionality after mechanical personalization – relationship of CQM requirements** for additional information how the various requirements for verifying contactless functionality after personalization interrelate.

12.1.6 #2806#: Antenna Design non-compliant with #2805# – IL Embossability

CQM Tag	#2806#		
CQM Requirement	12.1.6 #2806#: Antenna Design non-compliant with #2805# – IL Embossability		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Inlay with an antenna, but no IC - Inlay with an antenna, but no IC		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1250		
CQM Monitoring	20 items every Month.		

If the IL Vendor declares that the antenna itself can be embossed or indented as part of mechanical personalization and hence does not need to be outside of the areas foreseen for such mechanical personalization, then the IL Vendor shall qualify this declared characteristic by:

1. Producing sample cards from the IL to be tested using a well defined production process,
2. Demonstrating that these sample cards comply with **#2807#: Antenna Design non-compliant with #2805# – Card Embossability**,
3. Define the conditions and restrictions for the manufacturing of cards from this IL in a "Card Production Guideline" specification,
4. Define any restrictions with respect to locations where cards produced from this IL can receive mechanical personalization in a "Personalization Restrictions" specification.

An IL Vendor, declaring that the IL can sustain mechanical personalization in areas parts of the antenna are located in, shall:

- Refer to the detail test report demonstrating conformity to this requirement in the specification for the IL and make the detail test report available to customers upon request,
- Make the "Card Production Guideline" and the "Personalization Restrictions" specifications available to the card vendor upon request.

See **#BE00# Verification of contactless functionality after mechanical personalization – relationship of CQM requirements** for additional information how the various requirements for verifying contactless functionality after personalization interrelate.

12.1.7 #2807#: Antenna Design non-compliant with #2805# – Card Embossability

CQM Tag	#2807#		
CQM Requirement	12.1.7 #2807#: Antenna Design non-compliant with #2805# – Card Embossability		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Inlay with an antenna, but no IC - IC Card having a Contactless Interface - Inlay with an antenna and an IC, but no 7816-2 contacts - IAC having a Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1250		
CQM Monitoring	20 items every 3rd Month.		

If the card Vendor declares that the antenna itself can be embossed or indented as part of mechanical personalization and hence does not need to be outside of the areas foreseen for such mechanical personalization, then the card Vendor shall qualify this declared characteristic by one of two options:

12.1.7.1 Option 1 – Verify the IL is compliant with #2806#

The card Vendor shall:

- obtain from the IL vendor:

- the "Card Production Guideline" specification, and
- the "Personalization Restrictions" specification, and
- the IL qualification report demonstrating conformity with **#2806#: Antenna Design non-compliant with #2805# – IL Embossability**
- Verify, and demonstrate to the CQM Auditor's satisfaction, that the vendor's card production process complies with the "Card Production Guideline" issued by the IL Vendor, and
- Communicate to any customers intending to personalise the card the "Personalization Restrictions.

If the Vendor cannot comply with the requirements defined in this Option 1, but still wishes to declare the card construction to be suitable for mechanical personalization, then the Vendor must follow Option 2.

12.1.7.2 Option 2 – Verify the card is compliant with this requirement

If the Vendor wishes to declare the card to be suitable for mechanical personalization independently from the IL Vendor, then the Vendor shall qualify the card construction's suitability for mechanical personalization by:

1. Obtaining a related declaration from the IL Vendor and verify the IL Vendor has declared that this is possible with the supplied IL.
2. Randomly select sample cards
 - a. Sample size for Q-Factor and Resonance Frequency shall be at least 1250; it is permitted to just use CB with the antenna inlay for this test, provided that the type of antenna permits for meaningful measurements of Resonance Frequency and Q-Factor.
 - b. In addition, the sample size for Resonance Frequency, Q-Factor and Reading Distance shall be at least 200 fully functional cards.
 - c. If the vendor uses only fully functional cards for this test, then the total sample size shall be at least 1250, of which the vendor shall subject all cards to Resonance Frequency and Q-Factor measurement, and at least 200 in addition to Reading Distance measurement.
3. Measure Resonance Frequency, Q-Factor and Reading Distance of the sample cards and verify that all values for all cards are within tolerance ranges.
4. Personalizing the sample cards using the personalization technology the ICC Vendor claims possible. Personalization shall be made using 'worst case scenarios' like use of the character '8' for numeric positions and 'W' for alphanumeric positions and printing in all permitted locations.
5. Measuring again Resonance Frequency, Q-Factor and Reading Distance of the sample cards and verify that all values for all cards are within tolerance ranges, and that no significant change of the statistical distribution of any of these characteristics has occurred.

6. The vendor shall provide upon request the individual results and statistical analysis.
7. If any failures occur during any of these tests then this card construction shall be subjected to 100% control after mechanical personalization.

A Card Vendor, declaring that the antenna can sustain mechanical personalization in areas parts of the antenna are located in, shall refer to the detail test report in the specification for the Card and make the detail test reports for the Card and the utilized IL available to customers upon request.

See **#BE00# Verification of contactless functionality after mechanical personalization – relationship of CQM requirements** for additional information how the various requirements for verifying contactless functionality after personalization interrelate.

12.1.8#2809#: IC Location in IL, iLICC and IAC

CQM Tag	#2809#		
CQM Requirement	12.1.8 #2809#: IC Location in IL, iLICC and IAC		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Inlay produced using an unpackaged IC - IC Card produced using an IL containing the IC - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The embedded IC and its protective packaging shall not overlap with any of the following areas:

- Embossing
- Indent printing
- Hologram
- Signature panel
- any other area that might cause mechanical stress to the IC, e.g. during personalization

and meet the restrictions defined in the following specification:

- ISO/IEC 7810 and ISO/IEC 7811-1, 14443-1
- [CDS]

Test method: No method is defined here. The Vendor shall consider these requirements when designing the product and check them during qualification and report conformity in the qualification report.

12.1.9 #2810#: Inlays and cards containing inlays – Specification of Personalization Restrictions

CQM Tag	#2810#		
CQM Requirement	12.1.9 #2810#: Inlays and cards containing inlays – Specification of Personalization Restrictions		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- ICM including ISO/IEC 14443 Antenna - Any Inlay Activity - CB containing an inlay (but no IC) - Any IC Card - IACICM including ISO/IEC 14443 Antenna - Any IACIL - Any InterActive Card		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The Vendor of the IL, the CB containing an antenna, the ICC supplying any of these products to subsequent production steps shall specify any restriction with respect to personalization, such as restrictions to the embossable or indentable area, in the product specification.

The vendor shall take into account the possible desire of the personalization vendor to comply with **#4031#: Risk Management of Co-Existence of Antenna and Mechanical Personalization** and consider the requirements and guidance defined in **#4031#: Risk Management of Co-Existence of Antenna and Mechanical Personalization** when determining the restrictions for mechanical personalization.

12.1.10 #2811#: Recommendation – Maximum Size of Antenna

CQM Tag	#2811#		
CQM Requirement	12.1.10 #2811#: Recommendation – Maximum Size of Antenna		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products			
Test Method			
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		
Changelog:			
After V2.19.1	Editorial changes only: reference to AMD2 removed, as this is now incorporated into the 2018 version of 14443-1		

In order to improve the performance of the ICC, Mastercard recommends using the largest possible antenna size, compliant with the requirements defined in this document.

Antennae should be either ISO/IEC 14443-1 Class 1 or Class 2 for ID-1 sized ICC.

If the Vendor decides to use Class 2 antennae in an ID-1 ICC, no part of the antenna shall be located more than 29.00 mm from the top reference edge.

13 ID-1 Test Methods – Test Methods applicable to the components IL, CB, ICC, iacIL, and IAC

This chapter defines the Test Methods applicable to the components IL, CB, ICC, iacIL, and IAC.

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13.1 General Test Information and Measurement Conventions

13.1.1 General

The following default conditions apply to the testing conditions set in this section.

13.1.1.1 Climatic Conditions

Unless otherwise specified, assessment shall take place in an environment of temperature $23\text{ °C} \pm 3\text{ °C}$ and of relative humidity 40% to 60%.

13.1.1.2 Pre-Conditioning

Where the test method requires pre-conditioning, products that require testing shall be conditioned to the default climatic conditions defined above for a period of 24 h before testing unless otherwise specified in the test method.

13.1.1.3 Visual Check

Unless otherwise specified in the method, terms like 'visual check', 'visually check' or 'visually inspect' shall be interpreted as:

'being checked for conformity with the requirement by an inspector without uncompensated visual impairment like short- or wide-sightedness under standard daylight conditions (color temperature 6500 K) at a distance of 40 cm to 60 cm, with a viewing angle of 90° to the inspected surface and a lighting angle of 45° to the inspected surface'

13.1.2 Sampling Parameters

For each test, an appropriate sample size high enough so as to give a sufficient confidence level on the data ($\geq 95\%$), and on the standard deviation based on a normal (Gaussian) distribution curve, shall be used.

13.1.3 Reference Edges and Positions

The purpose of this section is to define:

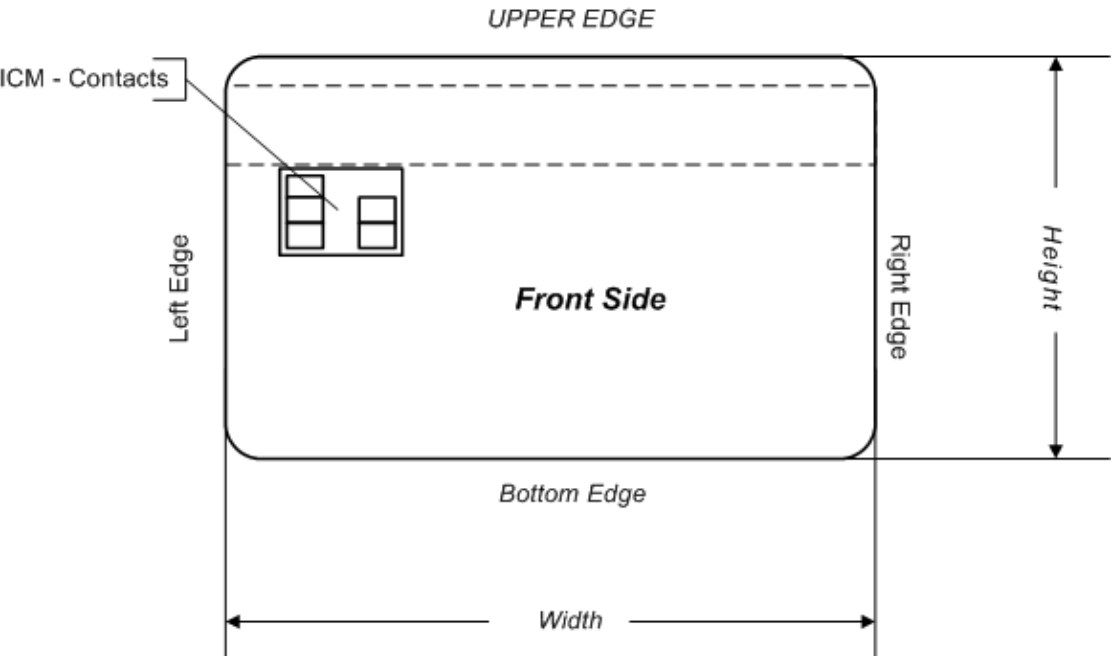
- The nomenclature of terms to be used for geometric description of a card, ICM or a component
- The reference axis to be used for each measurement of size, distance or position of one or the other element of the card.
- Standard reference: ISO/IEC 10373-1:2006 incorporating AMD1 and later editions of that standard.

13.1.3.1 #8900#: Card Edge

CQM Tag	#8900#
CQM Test Method	13.1.3.1 #8900#: Card Edge

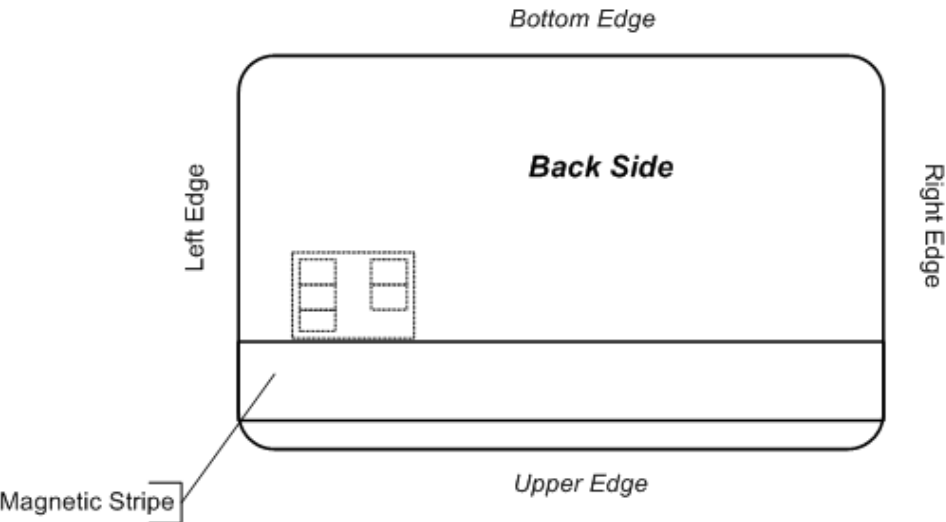
Front Side Up

Figure 12—Reference Edges – Front Side



Back Side Up:

Figure 13—Reference Edges – Back Side

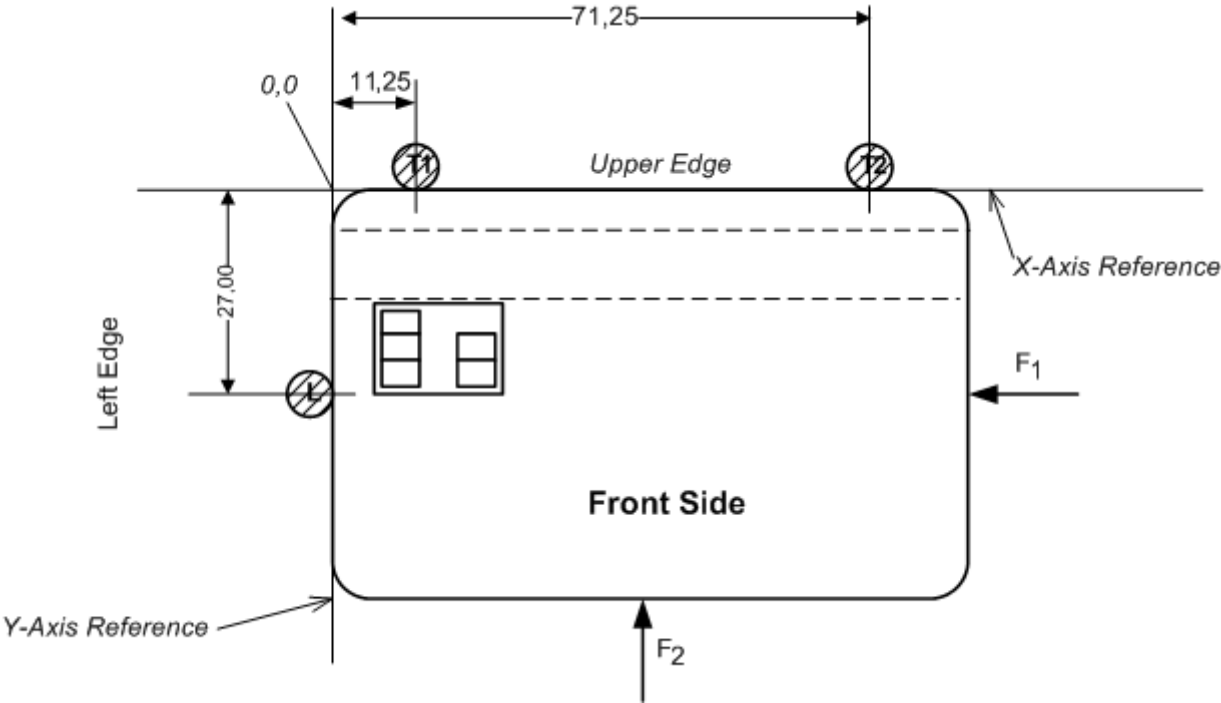


13.1.3.2 #8910#: Card Reference Position

CQM Tag	#8910#
CQM Test Method	13.1.3.2 #8910#: Card Reference Position

13.1.3.2.1 Front Side Up (normative)

Figure 14—Reference Position



All elements in **Figure 14** are mounted on a level rigid plate.

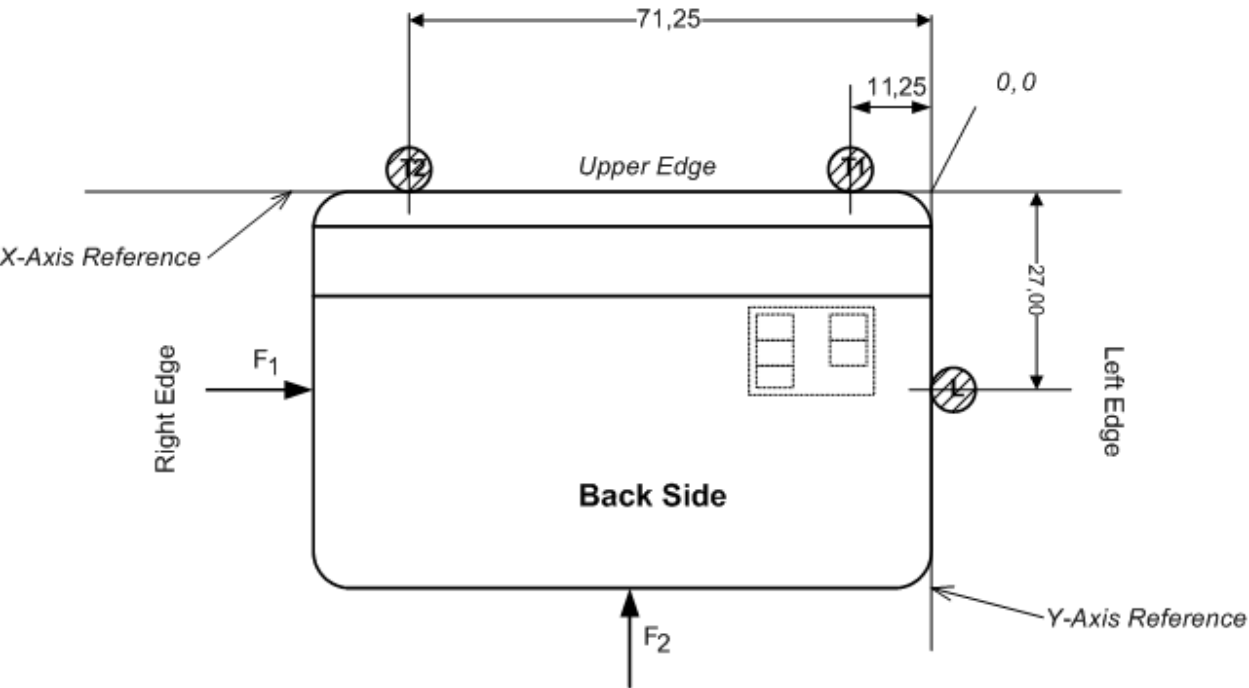
The Angle between the X-Axis_{Reference} and the Y-Axis_{Reference} shall be 90°.

L, T1 and T2 shall be metal cylinders having a diameter of 5 mm ± 0.1 mm and a surface roughness $R_a < 5 \mu\text{m}$.

The card shall be pressed against the cylinders L, T1 and T2 with the two forces $F_1 = 1 \text{ N}$ to 2 N and $F_2 = 2 \text{ N}$ to 4 N.

13.1.3.2.2 Back Side Up (informative)

Figure 15: Back Side Position



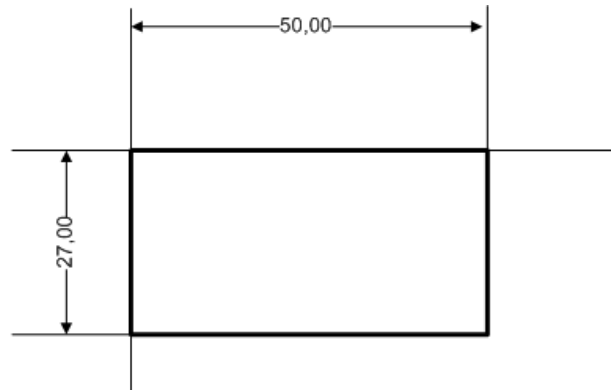
Note

This position is the same position as defined at the beginning of this section but seen from the Back Side of the card. Certain test methods require the inspection of the Back Side of the card. This drawing shall help avoid ambiguities in positioning of the card in case the Back Side needs to be inspected.

13.1.3.2.3 Optional Flattening Plate

A Flattening Plate to flatten the CB or ICC during measurements when positioning as defined in section #8300#.

Figure 16—Flattening Plate



The surface roughness of the Flattening Plate shall be $R_a < 5\mu\text{m}$.

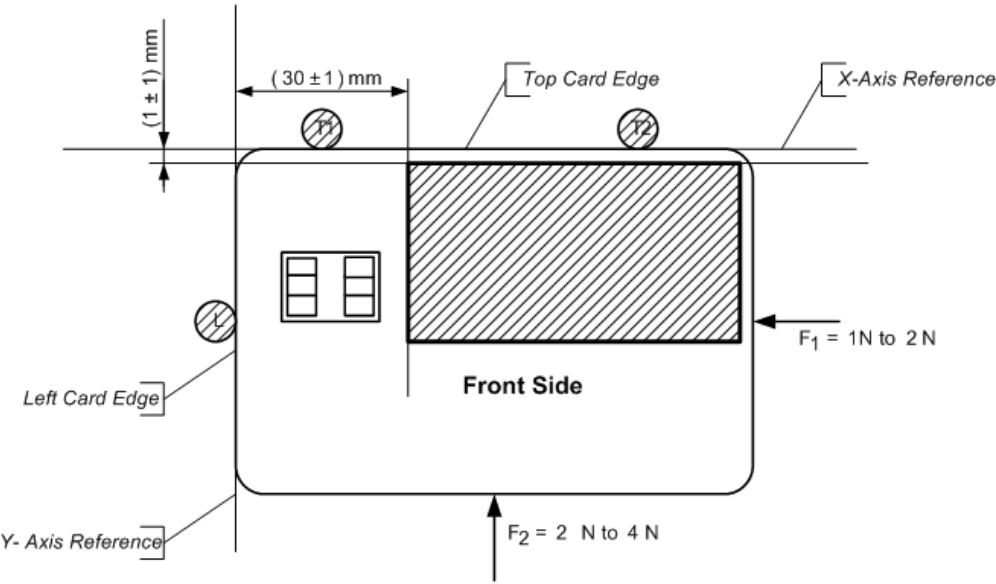
Dimensions in millimetres.

All Tolerances $\pm 0,1\text{ mm}$

13.1.3.2.4 Reference Position with Flattening Plate

Mount the CB or ICC and the Flattening Plate on the Reference-holder as shown in **Figure 17**.

Figure 17—Reference Position with Flattening Plate

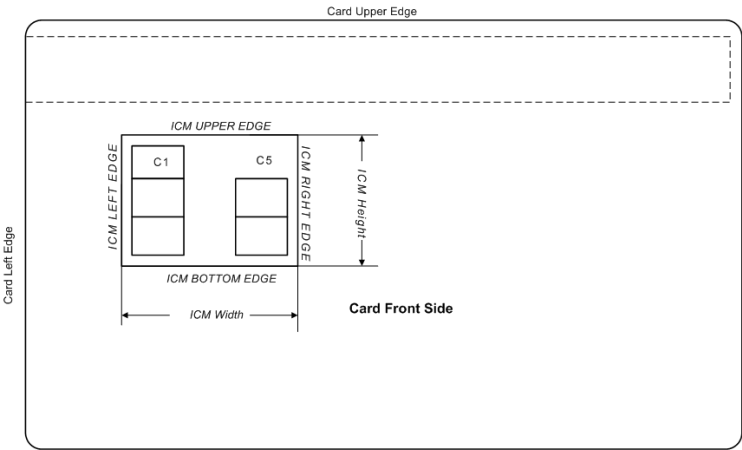


F₁ and F₂ are forces applied to the center of the right and the bottom edge of the card respectively to fix the card in the cardholder.
The Flattening Plate shall apply a force of 2,2 N ± 0,2 N to the surface of the card.

13.1.3.3 #8920#: ICM – EDGE

CQM Tag	#8920#
CQM Test Method	13.1.3.3 #8920#: ICM – EDGE

Figure 18—ICM – Edges



The side of the ICM visible in the drawing above, carrying the ICM/ICC-contacts shall be called *ICM contact side*. The opposite side shall be called the *ICM component side*.

13.2 CB, ICC and IAC – Test Methods applicable for ISO/IEC 7810 ID-1 shaped devices

13.2.1 #7010#: Pantone-Colors

CQM Tag	#7010#
CQM Test Method	13.2.1 #7010#: Pantone-Colors
Changelog:	
After V2.19.1	Editorial changes only: Test report refers now to DeltaE and no longer to Delta LCH

This procedure defines the test method, parameters and tolerances for colour and colour deviation to maintain the consistency of the printed brand marks.

Colours shall be controlled using a digital colour measurement system, typically called spectrometer, Spectrophotometer, or Spectrodensitometer, to eliminate most of the subjective influence in colour measurement and to allow easy and precise information exchange between parties concerned.

The colour is defined according to CIE LAB specification.

Use of following parameters is recommended:

- L^*ab for positioning the color in the colorimetric space
- ΔE^*_{Lab} CIEDE2000 for evaluating the distance between two colours

However, the parameters $L^*C^*H^\circ$, ΔL^* , ΔC^* , ΔH° may be used alternatively.



Note

*The relation between CIE $L^*C^*h^\circ$ and CIE $L^*a^*b^*$ is a single mathematical operation. $L^*C^*h^\circ$ is a polar coordinate system for the colour space and $L^*a^*b^*$ is an orthogonal one.*

13.2.1.1 Apparatus

Use a spectrophotometer with the following characteristics:

- Technology: 45/0
- Illuminant (light): D50
- Filter: Do not use a polarization filter
- Observer angle: 2°
- Measurement area: $d=3\text{mm}$

The spectrophotometer is provided with a colour finder that determines exactly the size of the surface on which the colour will be measured. The surface to be analyzed shall only contain a single colour.

Measurements shall only be made with finished laminated products (card or sheet).

1. Determine the value of the parameters L^*ab for each color with a Pantone®-Formula Guide. If determining the L^*ab for the colour from Pantone® Guides, use 3 different Pantone® Guides, at least one of them being less than a year old, the 2 others less than 2 years old. Make at least 3 measurements at different location of the relevant Pantone® field of each guide and calculate the average value of the 9 measurements and use this as the reference value for the specific colour.



Note

To control the colour after printing but before lamination it might be useful to 'fingerprint' the overlay, thus determine which change the overlay and lamination have for a given colour.

13.2.1.2 Test Method

This test method is applicable to the apparatus as defined above.

Test methods for a differing apparatus shall be developed by the Vendor, who must submit a request to Mastercard's CQM Certification Body for acceptance or rejection.

The color measurement shall be made with a spectrophotometer configured as defined in section **13.2.1.1 "Apparatus "**.

- Verify white calibration
- Identify the measurement area on the card, verify that the size complies to the apparatus' requirement, verify that the color in this area appears homogeneous
- Make 3 measurements; the result is the average of these three values

13.2.1.3 Test Report

The test report shall indicate the reference values for CIE parameters and the distance for each measured value to the reference values.

The distance ΔE^*_{Lab} CIEDE2000 from the measured value to the standard value shall be within the defined tolerance ranges.

13.2.2 #7020#: Metallic Colors

CQM Tag	#7020#
CQM Test Method	13.2.2 #7020#: Metallic Colors
Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): removed

13.2.3 #7030#: Registration and Positioning

CQM Tag	#7030#
CQM Test Method	13.2.3 #7030#: Registration and Positioning
Changelog:	

After V2.19.1	Technical changes (incl. editorial changes): various changes to improve usability
---------------	--

13.2.3.1 Apparatus

For verifying conformity of positioning: any optical or digital measurement equipment with an accuracy of 0.1 mm or better may be used.

13.2.3.2 Procedure

1. Registration: Visually inspect the sample with the unaided eye. No registration defect shall be visible.
2. Position: place the card on a flat surface under the measurement equipment and proceed to each specified measurement: positioning of elements against card edges, positioning of the elements between them and size. Compare each measured value against the nominal values and permitted tolerances.

13.2.3.3 Report

Registration: the report shall indicate if registration defects (trapping and reverse trapping) are visible or not.

Position: for each position measurement, the report shall indicate the maximum and the average values. All values shall be within the tolerance limits.

13.2.4 #7040#: Printing Aspect

CQM Tag	#7040#
CQM Test Method	13.2.4 #7040#: Printing Aspect

13.2.4.1 Apparatus

Visual check or computerized video digital system.

13.2.4.2 Procedure

Visual check of the card's artwork. No printing aspect defect shall be visible.

13.2.4.3 Report

The report shall indicate which type of defects and how many of them were found for a given batch of cards. Moreover, these defects shall be sorted according to a defects classification defined by the Vendor.

13.2.5 #7050#: Card Aspect

CQM Tag	#7050#
CQM Test Method	13.2.5 #7050#: Card Aspect

13.2.5.1 Apparatus

Visual check or computerized digital video system.

13.2.5.2 Procedure

Check card visually.

13.2.5.3 Report

The report shall indicate which type of defects and how many of them were found for a given batch of cards. Moreover, these defects shall be sorted according to a defect classification defined by the Vendor.

13.2.6 #7100#: UV – Printing

CQM Tag	#7100#
CQM Test Method	13.2.6 #7100#: UV – Printing

13.2.6.1 Apparatus

To check for adequate visibility of the print under UV light:

- UV lamp having a spectrum peak at $365\text{ nm} \pm 10\text{ nm}$ for manual inspection; or a computerized video inspection system with similar characteristics.

To check the UV print is not visible under normal daylight:

- UV lamp covering the wavelength of 450 nm in its spectrum, and having a filter eliminating the part of the spectrum below $410\text{ nm} \pm 10\text{ nm}$ for manual inspection; or a computerized video inspection system with similar characteristics.



Note

Pigments typically used for the printing of UV visible features have an emission peak around 450 nm (blue), 515 nm (green), 540 nm (yellow), and 620 nm (red).

13.2.6.2 Procedure

1. The CB Provider shall prepare its own internal reference system according to the following.

Print a set of reference cards with using ink and printing technology foreseen for the volume production with the following characteristics:

- Dark and light background
- Maximum and minimum acceptable level of intensity of the UV printing under 365 nm (shall be visible) and under 450 nm (should not be visible) wavelength light.

The manufacturer is responsible for choosing the max and min levels.

2. Save one set of reference cards in a dark secure place; use another set during the production process for control. Carry out periodical controls of the set in production using the saved set.
3. Intensity and color: visually check by comparing the cards against the specimen cards.
4. Size and positioning: please refer to the apparatus and procedure defined for the positioning measurements described in section **#7030#: Registration and Positioning**.

13.2.6.3 Report

The report shall indicate the deviations related to:

- The intensity and color,
- The size and positioning.

13.2.7 #7110#: Printed Security Elements

CQM Tag	#7110#
CQM Test Method	13.2.7 #7110#: Printed Security Elements

13.2.7.1 Apparatus

Visual check or computerized video digital system.

13.2.7.2 Procedure

1. Contrast: visual check of the element.
2. Size and positioning: please refer to the procedure defined for the positioning measurements described in section **#7030#: Registration and Positioning**.

13.2.7.3 Report

For each printed security element, the report shall indicate:

- The contrast,
- The size and positioning.

13.2.8 #7120#: Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) –Aspect and Shape, Size and Positioning

CQM Tag	#7120#
CQM Test Method	13.2.8 #7120#: Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) –Aspect and Shape, Size and Positioning
Changelog:	
After V2.22	Technical changes (incl. editorial changes): clarified that if cross-hatch necessary, a new sample shall be used.

After V2.22.1	Editorial changes only: #7120# split into two separate requirements, one for visual, one for adhesion
---------------	--

13.2.8.1 Apparatus

- Bare eye
- Diffuse lighting creating an illuminance of 650 lux \pm 100 lux at the position of the device to be inspected, with the lightsource being fluorescent light bulbs or LEDs, and a color temperature between 3000K and 6000K.

For size and positioning: refer to the apparatus defined for the positioning measurements described in section **#7030#**: *Registration and Positioning*.

13.2.8.2 Procedure

1. Visually inspect the hologram with unaided eyes at a distance of 450 mm \pm 75 mm from the eye of the inspector

For size and positioning: please refer to the procedure described in section **#7030#**: *Registration and Positioning*.

13.2.8.3 Report

The report shall indicate which type of defects and how many of them were found for a given batch of cards. Defects may concern the physical aspect (e.g. spots, holes, edges) and shape, size and positioning, adhesion. Moreover, these defects shall be sorted according to a defects classification defined by the Vendor.

13.2.9 #7121#: Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) – Adhesion

CQM Tag	#7121#
CQM Test Method	13.2.9 #7121#: Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) – Adhesion
Changelog:	
After V2.22	Technical changes (incl. editorial changes): clarified that if cross-hatch necessary, a new sample shall be used.
After V2.22.1	Editorial changes only: #7120# split into two separate requirements, one for visual, one for adhesion

13.2.9.1 Apparatus

For Adhesive Tape test:

- Adhesive tape with an adhesive strength (10 ± 1) N per 25 mm width²¹, tested in accordance with IEC 60454-2. The tape shall at least have the width of the surface feature to be tested.

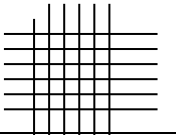
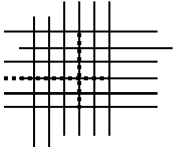
For Cross Hatch test:

- Adhesive tape with an adhesive strength (10 ± 1) N per 25 mm width, tested in accordance with IEC 60454-2. The tape shall at least have the width of the surface feature to be tested,
- Standardized knife with 6 blades, each of them being separated by 1.0 mm as required in ISO/IEC 24789-2. The use of existing cutters with a blade distance of 1.5 mm is permitted for the time being.

13.2.9.2 Procedure

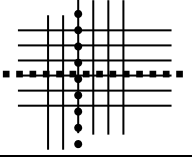
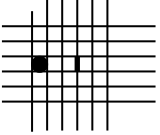
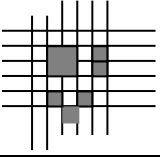
- Adhesive tape test: place the card on a flat surface. Apply a piece of adhesive tape over the Security Device with a minimum length of 20 mm. Firmly rub the tape in a regular way to ensure a secure bond. Wait for at least 1 minute. Then pull off the tape very quickly at an angle of about 60 degrees. Check the tape for particles and the Security Device for voids. The test is passed if:
 - no Security Device particles are visible on the tape, and
 - no voids appear inside the Security Device.
- When the adhesive tape test provides a negative result, proceed to the cross-hatch test as defined in ISO 2409, using another sample.
- Cross hatch test: place the card on a flat surface. Cut the Security Device with the 6-blade knife in two perpendicular directions. The applied strength on the knife shall be regular and strong enough to cut the hologram but not the overlay underneath. Then, proceed to the adhesive tape test applying the tape parallel to one of the cutting directions. Check the adhesive tape and the substrate and proceed to classification on basis of the following table:

Table 13.1—Cross Hatch Test Criteria

Class	Description	Aspect
0	All edges of the incised lines are perfectly straight and neat. No square comes off from the grid area.	
1	Some small particles come off from the points of intersection of the incised lines. This defect affects less than 5% of the grid area.	

²¹ (10 ± 1) N per 25 mm width is app 3.9 N/cm and 36 oz./in. Known adhesive tapes with this adhesive strength are 3M Masking Tape 401+, Tesa 60404.

ID-1 Test Methods – Test Methods applicable to the components IL, CB, ICC, iacIL, and IAC
CB, ICC and IAC – Test Methods applicable for ISO/IEC 7810 ID-1 shaped devices

2	Some particles of the hologram come off from the edges of the incised lines or from the points of intersection. This defect affects from 5% to 15% of the grid area	
3	The same defect as #2 is present with additionally some squares of the hologram coming off in a discontinuous way. This defect affects from 15% to 35 % of the grid area.	
4	The same defect as #3 is present with additionally adjacent squares of hologram coming off from the grid area in stripes or large areas covering from 35% to 65 % of the grid area.	
5	Peel off above class #4	

Accept/Reject criteria:

- Accept: Classes 0 and 1
- Reject: Classes 2... 5

13.2.9.3 Report

The report shall indicate which type of defects and how many of them were found for a given batch of cards. Defects may concern the physical aspect (e.g. spots, holes, edges) and shape, size and positioning, adhesion. Moreover, these defects shall be sorted according to a defects classification defined by the Vendor except for the adhesion defects, where the classification shall be in accordance with the above table of defects.

13.2.10 #7130#: Signature Panel

CQM Tag	#7130#
CQM Test Method	13.2.10 #7130#: Signature Panel

13.2.10.1 Apparatus, Procedure and Report

Refer to **#7120#: Security Devices (Hologram, PBM, magnetic stripe with hologram like surface, Signature Panel) –Aspect and Shape, Size and Positioning**.

13.2.11 #8010#: Relative Height of Contacts

CQM Tag	#8010#
CQM Test Method	13.2.11 #8010#: Relative Height of Contacts

The purpose of this test method is to determine the difference in height between the ICC contacts and the adjacent card surface.

13.2.11.1 External method:

Use the method "Surface profile of contacts of ICCs with contacts" defined in ISO/IEC 10373-1, but with the following amendment:

- If the card does only show physical contacts, and no indication of an ICM or other discernible edge of the contact area beyond the physical contacts such as a punched opening in the top layers of the card to expose the contacts, then the measurement line shall start 2 mm from the left edge of the leftmost contact and end 2 mm from the right edge of the rightmost contact.

For process control purposes, the use of a thickness indicator is recommended. The thickness indicator shall have an accuracy equal of better than ± 0.01 mm. The base of the measurement apparatus shall be flat with an area of at least 50 mm x 50 mm. The measurement tip shall be flat with a diameter between 0.5 mm and 2 mm.

13.2.12 #8020#: Dimension and Location of Contacts

CQM Tag	#8020#
CQM Test Method	13.2.12 #8020#: Dimension and Location of Contacts

13.2.12.1 External method:

Use the method "Dimension and Location of Contacts for ICCs with contacts" defined in ISO/IEC 10373-1.

For Process Control purposes, the use of an overlay template showing the ISO/IEC 7816-2 minimum contact areas is highly recommended as the test tool.

13.2.13 #8030#: Width and Height [IS10373-1]

CQM Tag	#8030#
CQM Test Method	13.2.13 #8030#: Width and Height [IS10373-1]

13.2.13.1 External method:

Use the method "Height and width of card measurement" defined in ISO/IEC 10373-1.

13.2.14 #8040#: Card Thickness outside Contacts, Embossed Areas and Add-on Areas [IS10373-1]

CQM Tag	#8040#
CQM Test Method	13.2.14 #8040#: Card Thickness outside Contacts, Embossed Areas and Add-on Areas [IS10373-1]

13.2.14.1 External method:

Use the method "Thickness of card measurements" defined in ISO/IEC 10373-1.

13.2.15 #8050#: Thickness within Add-on Areas [IS10373-1]

CQM Tag	#8050#
CQM Test Method	13.2.15 #8050#: Thickness within Add-on Areas [IS10373-1]



Note

Perform the "Thickness within Add-On Areas" – method after performing the "Card thickness outside Contacts, Embossed Areas and Add-On Areas" – method, as those results are used in this Procedure.

13.2.15.1 Apparatus

A micrometer with an accuracy of $\pm 2.5 \mu\text{m}$, with a flat anvil and a flat measurement probe, both having a diameter within the range of 3 mm to 8 mm. The force applied by the probe shall be between 3.5 N to 5.9 N.

13.2.15.2 Procedure

1. Pre-condition the Card.
2. Use the micrometer to measure the thickness of the Card at three different locations on the Add-On-Area, one in the center, the other two close to the left and the right edge of the Add-On-Area.
3. Calculate the arithmetic average of the three values ('thickness inside Add-On Area') and subtract the arithmetic average thickness determined in section: #8040#: Card Thickness outside Contacts, Embossed Areas and Add-on Areas [IS10373-1].
4. Perform steps 1 to 3 for every Add-On Area.

13.2.15.3 Test Report

The Test Report shall give the difference between the 'thickness inside Add-On-Area' and the 'thickness outside Add-On-Area' as the relative height of the Add-On Area for each Add-On Area separately.

13.2.16 #8060#: Corners [IS10373-1]

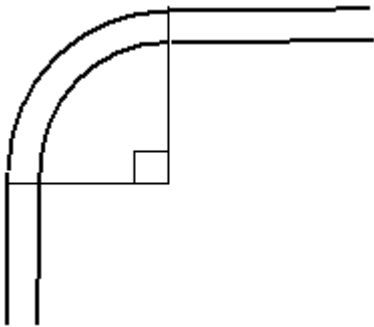
CQM Tag	#8060#
CQM Test Method	13.2.16 #8060#: Corners [IS10373-1]

13.2.16.1 Apparatus

A white light microscope or profile projector with a minimum magnification of $\times 10$, with the light source behind the Card.

A pattern with two quadrants of two concentric circles having diameters defined for the maximum and minimum radius in section #3005#. The pattern shall be designed in accordance with **Figure 19**.

Figure 19—Pattern to Determine Conformance of Card Radii



The precision of the pattern shall be at least 10 times the tolerance multiplied by the magnification of the white light microscope or of the profile projector.



Note

Other means of determining the radius and the transition from straight edge to radius may be used, as long as the result is comparable with the result of this procedure.

13.2.16.2 Procedure

1. Try to place each corner between the two quadrants of the pattern. If the corner fits between the two circle lines, and the adjacent Card edges fit between the parallels, assume that the radius of the corner is compliant with the requirement.
2. Repeat this test for each corner.

Perform this test with the front side up.

13.2.16.3 Test Report

The Test Report shall state, if all corners are compliant with the requirement.

13.2.17 #8070#: Card Edges [IS10373-1]

CQM Tag	#8070#
CQM Test Method	13.2.17 #8070#: Card Edges [IS10373-1]

13.2.17.1 Apparatus

Profile projector or similar with magnitude X10

13.2.17.2 Procedure

1. Determine the presence of distortions of the four edges of the Card. Distortions may be edge-burrs or notches e.g. generated by a worn out punching tool.
2. As a guideline for precision each edge shall be observed at a distance of app. 40 cm for app. 1 s with light conditions similar to normal daylight with the bare eye. In addition,

sliding a finger along the edge to feel for burrs, notches and other imperfections is usually helpful.

3. In case of doubt, proceed to measuring the height of burrs using a profile projector x10 or similar device.

13.2.17.3 Test Report

The Test Report shall report the detected distortions on the Card edges.

13.2.18 #8080#: Bending Stiffness [IS10373-1]

CQM Tag	#8080#
CQM Test Method	13.2.18 #8080#: Bending Stiffness [IS10373-1]

13.2.18.1 External method:

Use the method "Bending stiffness" defined in ISO/IEC 10373-1, but with the following amendment:

- The card shall comply with the requirement in all 4 possible orientations (either side up, either short edge clamped). The limitation by the wording of the current version of 10373-1 practically requiring the card to only comply when the left edge is clamped and the contacts are up does not apply.

13.2.19 #8091#: Durability – Dimensional Stability with Temperature and Humidity

CQM Tag	#8091#
CQM Test Method	13.2.19 #8091#: Durability – Dimensional Stability with Temperature and Humidity

The purpose of this test is to test the compliance of the Card with the Requirements during its expected lifetime by submitting the Card to defined climatic conditions and checking compliance with selected physical Requirements.

13.2.19.1 Apparatus

Climatic chamber with the capability to generate a climate within the following limits:

- Temperature $T = 23\text{ °C to }100\text{ °C} \pm 3\text{ °C}$
- Relative humidity r.H. = 5 % to 95 % $\pm 5\%$ ²².

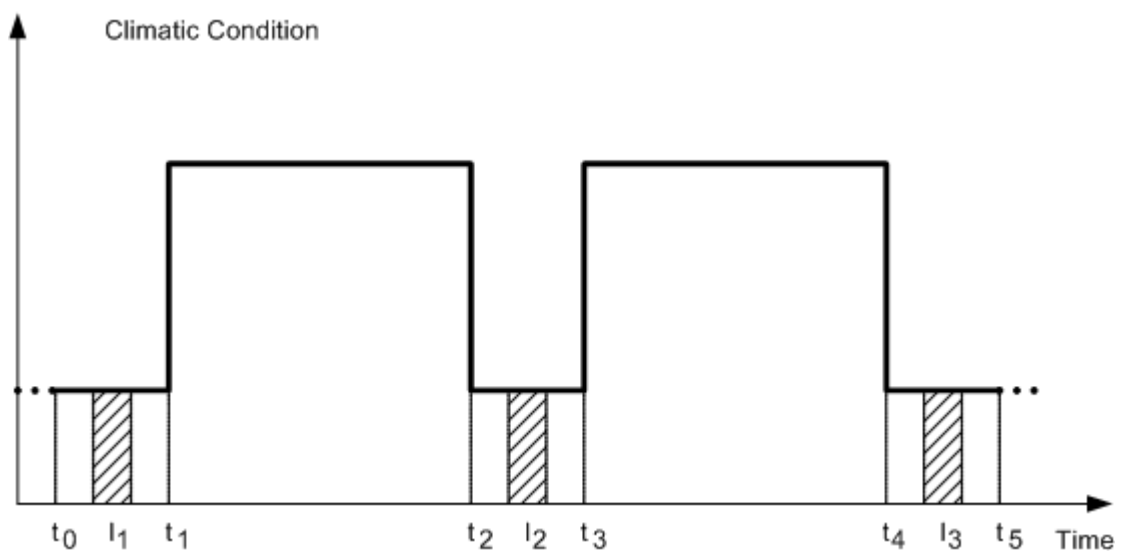
13.2.19.2 Procedure

1. Determine the following characteristics of the card:

²² At temperatures above 90° C the climatic condition may be without humidity control, due to technical limitations of the climatic chamber.

- Width and Height
 - Overall Card warpage
 - Visual aspect of Card
 - For ICC that the card is electrically and electromagnetically functional
2. Submit the Cards to the sequence shown in **Figure 20**.

Figure 20—Durability, Temperature and Humidity Profile



$t_0 - t_1$ = default conditions

$t_1 - t_2$ = 72h, $T = 60\text{ }^{\circ}\text{C}$, $\text{RH} = 95\%$

$t_2 - t_3$ = default conditions

$t_3 - t_4$ = 72h, $T = 60\text{ }^{\circ}\text{C}$, $\text{RH} = 10\%$

$t_4 - t_5$ = default conditions

l_1 , l_2 and l_3 are the intervals during which the determinations are performed with:

$t_2 + 1\text{h} \leq l_2 \leq t_2 + 4\text{h}$ and $t_4 + 1\text{h} \leq l_3 \leq t_4 + 4\text{h}$

3. Determine during l_2 and l_3 :
- Width and Height, and calculate the dimensional change relative to the Width and Height determined at the beginning of the test
- And then check conformity with the following requirements:
- Overall Card warpage
 - Visual aspect of Card
 - That the card is fully functional



Note

The negative temperature defined in the requirement is skipped in this test, as no impact on the card is expected.

13.2.19.3 Test Report

The Test Report shall state:

- Width and Height at the beginning of the test and during I2 and I3, and the dimensional changes of the measurements taken during I2 and I3 relative to the measurements taken at the beginning of the test.
- Whether, and to which extent, the card remained fully functional.

13.2.20 #8092#: Exposure to Temperature and Humidity [IS24789-2]

CQM Tag	#8092#
CQM Test Method	13.2.20 #8092#: Exposure to Temperature and Humidity [IS24789-2]

13.2.20.1 Apparatus

Apparatus as required in ISO/IEC 24789-2 "Temperature and humidity aging"

13.2.20.2 Procedure

Follow the procedure defined in ISO/IEC 24789-2 "Temperature and humidity aging", but with the temperature defined by the referencing requirement and for the duration specified by the referencing requirement.

13.2.20.3 Test report

Report conformity for the characteristics defined by the requirement.

13.2.21 #8100#: Overall Card Warpage [IS10373-1]

CQM Tag	#8100#
CQM Test Method	13.2.21 #8100#: Overall Card Warpage [IS10373-1]

The purpose of this test is to measure the degree of warpage of a Card

13.2.21.1 Apparatus

A Level rigid plate.

Any equipment capable to perform the Procedure described below with an accuracy of 0,01 mm. (according ISO/IEC 10373-1 section 5.1.1). Care shall be taken to ensure, the measurement equipment does not deform the Card.

13.2.21.2 Procedure

1. Pre-condition the Card.

2. Place the Card on the level rigid plate. At least three corners of the Card shall rest on the plate (warpage of the Card in convex form to the plate).
3. Determine the distance between the level rigid plate and the point on the surface of the card with the maximum distance²³ to the level rigid plate, measured perpendicular to the level rigid plate.

Alternatively, the use of an adequate gauge for process control purposes is permitted, as long as the gauge and method ensure that Cards not conforming to the requirement are identified and rejected.

13.2.21.3 Test Report

The Test Report shall state if the warpage was measured or checked against a maximum value using a gauge.

In case of measurement the Test Report shall state the maximum distance between the level rigid plate and the surface of the Card opposite to the level rigid plate.

In case of the use of a gauge, the test report shall state that the warpage is less than the lowest warpage value the gauge would reject, and provide that warpage value.

13.2.22 #8110#: Resistance to Heat [IS10373-1]

CQM Tag	#8110#
CQM Test Method	13.2.22 #8110#: Resistance to Heat [IS10373-1]

The ability to resist heat is determined by exposing the card to certain climatic conditions for a certain time and measuring the mechanical deformation caused by the influence of gravity.

13.2.22.1 External method:

Use the method "Resistance to heat" defined in ISO/IEC 10373-1, but with the temperature defined in #3045#.

13.2.23 #8120#: Peel Strength Test [IS10373-1]

CQM Tag	#8120#
CQM Test Method	13.2.23 #8120#: Peel Strength Test [IS10373-1]

13.2.23.1 External Method:

Use the method "Peel Strength" defined in ISO/IEC 10373-1.

²³ The point with the maximum distance to the level rigid plate is not necessarily in the centre of the card.

13.2.23.2 Additional Notes regarding the application of the peel test

Some measurement devices offer the option to automatically determine the minimum force obtained during the recording. This value is usually not the minimum peel strength as determined by this method as spikes of a length of less than 1 mm are not filtered out, unless the force measurement device applies such filter. Anyhow, the minimum peel strength to be determined by this method may be assumed to be equal or greater than the unfiltered minimum force automatically determined by the equipment.

Automatically determined 'average' or 'maximum' peel forces by the force measurement device are not the minimum peel strength as are intended to be determined by this method.

If the adhesion is strong between layers, the layer peeled may start to tear during the measurement, causing lower peel strength values to be measured by the device. Such areas shall be marked on the recording and excluded from determining the minimum peel strength. Similar might occur in the area of IC Card contacts and such area shall also be marked on the recording and excluded from determining the minimum peel strength.

An area of very strong adhesion might be located between two areas of weak adhesion, causing the peeled layer to tear after the first area of weak adhesion, thus voiding the measurement of the second area of weak adhesion. In this case it is required to make the measurement from both directions to ensure both edges of the card are tested.

Where the sample preparation is not possible from both edges due to the adhesion between two layers being too strong, e.g. as may be the case between two properly laminated PVC core foils, the test may be assumed a pass.

CQM strongly recommends to always use a Stabilizing Plate. A Stabilizing Plate is required when the core is deformed during the test to an extent that the result is significantly influenced.

A suitable Stabilizing Plate for specimen taken from an ID-1 sized card is a 60 mm × 90 mm × 2 mm aluminum plate attached with double sided adhesive tape to the specimen.

13.2.24 #8240# Advanced Peel Strength Test

CQM Tag	#8240#
CQM Test Method	13.2.24 #8240# Advanced Peel Strength Test
Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): Adjusted to modifications in 10373-1, clarified that each strip must be tested in both directions. Added provisions to address periodic oscillations or rippling through retesting at lower peel speed.

To achieve this, this test method offers two approaches:

- Using the test method defined in ISO/IEC 10373-1, or
- Using a specific arrangement around the peeling equipment rollers to keep the card under tension during the test.

Use the method "Peel strength including the edge of the card" from ISO/IEC 10373-1:2020.



Note

As an alternative the vendor is permitted, until a new method is mandated in this document, to determine peel strength using #8120# and in addition determine conformity with #3018# using cards from the same batch. Note that different samples are needed for #8120# and for determining conformity with #3018#, as each test method renders the card unsuitable for the other.

The purpose of this test is to measure the peel strength between two layers of the card. The sample is cut into 1 cm wide strips and the top layer(s) of this strip are peeled off the core of the card and the force necessary to peel the top layer(s) off the core of the card is recorded.

For cards that are manufactured in a larger format like a lamination sheet and then punched to size, there are two ways of preparing the sample, one using the punched ID-1 sized card, the other using the larger format. Using the larger format can reduce the number of measurements required as the peel strength at both edges of the card can be measured in one go.

13.2.24.1 Method 1 – using a prolonged Stabilizing Plate and spacer, e.g. a second card

13.2.24.1.1 Introduction

This method is suitable for cards independent of their bending stiffness.

13.2.24.1.2 External Method:

Use the method "Peel Strength including the edge of the card" defined in ISO/IEC 10373-1, but with the following modifications:

13.2.24.1.3 Procedure



Note

The procedure required by CQM differs from the one defined in ISO/IEC 10373-1 in the type and number of samples required. Hence, conduct the procedure as defined in ISO/IEC 10373-1 but with the sample strips as defined below.

13.2.24.1.3.1 Definition

Term	Definition
Card	ID-1 card punched from a sheet or otherwise made to measure
Sample	Card prepared for peel strength test
Test Area	Area of the Card that is cut into Specimen
Test Section, Specimen	1 cm wide strip of card material, cut from a Card

13.2.24.1.3.2 Introduction

This test procedure shall be applied to the Layer Interface specified by the requirement.

The test procedure requires removing the first app. 10 mm of the layer to be tested so it can be gripped by the test device. In addition, the measurements for the first few mm are not reliable, so that the test does not determine measurements for app. the first 15 mm of the sample.

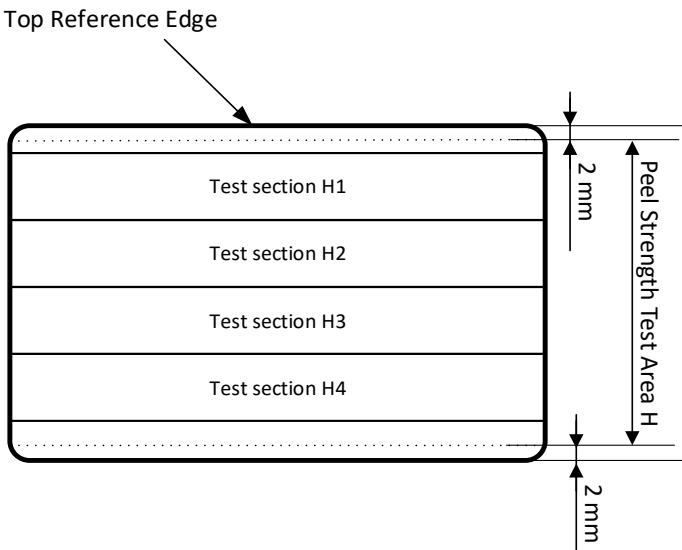
This implies that unless samples are taken from a laminated sheet and extend at least 15 mm from the intended edge of the card, each strip of the card must be tested twice (and hence two samples of each strip are needed), once beginning at the one, and once beginning at the other end of the strip.

Delamination usually occurs at the edge of the card and therefor controlling adhesion at the edge of the card through peel strength measurement is necessary.

13.2.24.1.3.3 Prepare the needed specimen from ID-1 sized samples

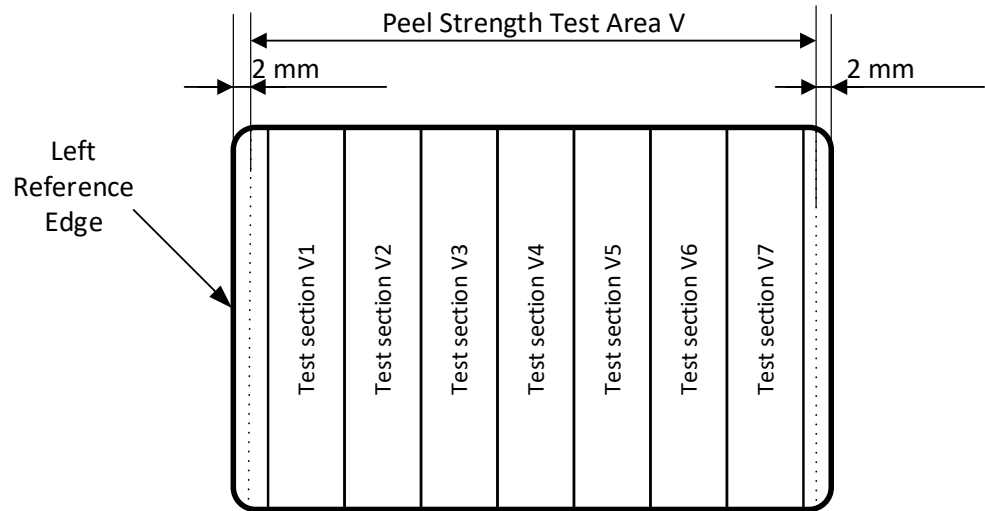
To determine the peel strength close to the short edges of the card, the card is split into test sections H1 to H4 as shown in **Figure 21** :

Figure 21 – Card Preparation – horizontal test sections



For determining the peel strength close to the long edges of the card, the card is split into test sections V1 to V7 as shown in **Figure 22** :

Figure 22 – Card Preparation – vertical test sections



The following specimen are required for the test of the peel strength of an interface, depending on the type of interface:

Type of Interface	Required Test Sections
Interface containing printed inks, e.g. overlay to printed core, where there are no significant differences in the print along the edges of the card, e.g. the card being printed full face screen printed gold	H1, H4; one direction suffices
Interface containing printed inks, e.g. overlay to printed core, where there are significant differences in the print along the edges of the card, e.g. upper edge in 100% offset printed black and the right and left edge in screen printed silver	H1, H4, V1, V7; both directions, hence two specimens of each test section
Homogenous interface, e.g. two PVC core foils without any inks in the interface	H2; one direction suffices
Interface containing a wire embedded antenna between two otherwise homogenous layers, e.g. two PVC core foils	H1, H4, V1, V7; one direction suffices
Interface containing an etched or hot stamped antenna, or an interface between two inhomogeneous layers, e.g. batteries or electronics	H1, H2, H3, H4, V1, V2, V3, V4, V5, V6, V7; both directions, hence two specimens of each test section

13.2.24.1.4 Test Report

The test report shall provide the Peel Strength for each test section, both the value for the Peel Strength at the edge of the card, and the Peel Strength in the center of the card.

In addition, the test report shall provide the overall lowest Peel Strength.

13.2.24.2 Additional Notes regarding the application of the peel test

Some measurement devices offer the option to automatically determine the minimum force obtained during the recording. This value is usually not the minimum peel strength as determined by this method as spikes of a length of less than 1 mm are not filtered out, unless the force measurement device applies such filter. Anyhow, the minimum peel strength to be determined by this method may be assumed to be equal or greater than the unfiltered minimum force automatically determined by the equipment.

Automatically determined 'average' or 'maximum' peel forces by the force measurement device are not the minimum peel strength as are intended to be determined by this method.

If the adhesion is strong between layers, the layer peeled may start to tear during the measurement, causing lower peel strength to be measured by the device. Such areas shall be marked on the recording and excluded from determining the minimum peel strength. Similar might occur in the area of IC Card contacts and such area shall also be marked on the recording and excluded from determining the minimum peel strength.

An area of very strong adhesion might be located between two areas of weak adhesion, causing the peeled layer to tear after the first area of weak adhesion, thus voiding the measurement of the second area of weak adhesion. In this case it is required to make the measurement from both directions to ensure both edges of the card are tested.

Where the sample preparation is not possible from both edges due to the adhesion between two layers being too strong, e.g. as may be the case between two properly laminated PVC core foils, the test may be assumed a pass.

The Stabilizing Plate is required when the core is deformed during the test to an extent that the result is significantly influenced. To determine the peel strength at the edge of a Specimen cut from a Card the Stabilizing Plate is always required.

The measurement result may show periodic oscillations, also referred to as rippling or stick-slip effects, where the peel strength record rapidly oscillates between a high and a low value, with 'rapidly' understood as 'no more than 5 mm between minimum and maximum. These periodic oscillations can sometimes be avoided by reducing the peel speed, e.g. to 50 mm/minute instead of the 300 mm/minute ISO/IEC 10373-1 proposes. If periodic oscillations occur at 300 mm/minute peel speed, then it is permitted to repeat the test at lower speeds. If the results at the lower speed avoid the periodic oscillations, the vendor retains the original peel strength results taken at 300 mm/minute, and records the actual speed the measurements at a lower speed were taken, and the results taken at a lower speed indicate compliance with the relevant requirement while the results taken

at 300 mm/minute did not due to the periodic oscillations, then the entire test result may be taken as evidence for compliance with the requirement.

13.2.24.3 Method 2 – using a modified peel mechanism

13.2.24.3.1 Introduction

This method is suitable for cards that have a bending stiffness somewhat compliant with ISO/IEC 7810, and is not suitable for rigid cards like those made of metal.

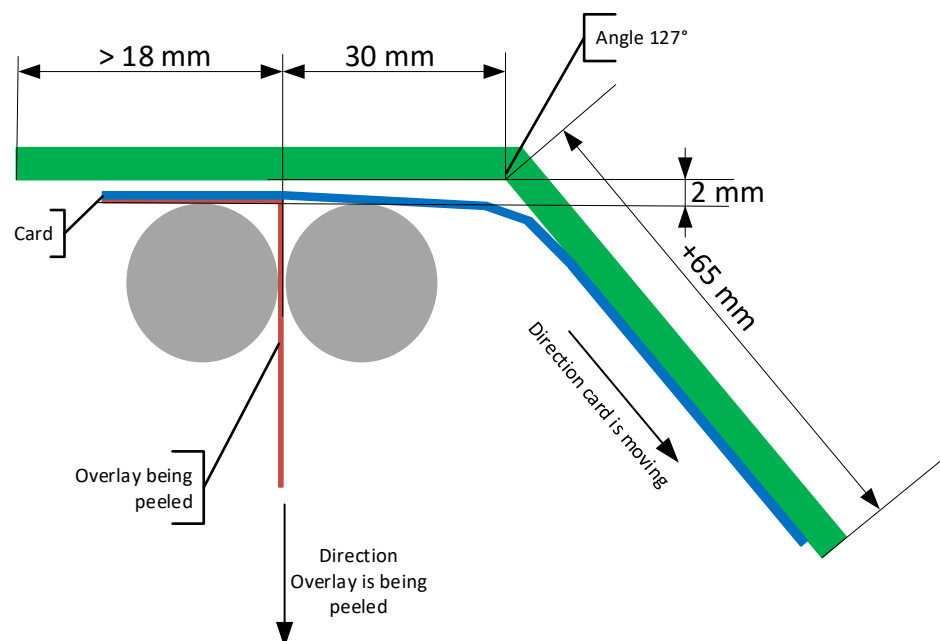
This method does not require the use of a stabilizing plate.

13.2.24.3.2 External Method:

Use the method "Peel Strength" defined in ISO/IEC 10373-1, but with the modified apparatus defined below, and the other modifications defined in section 13.2.24.1
Method 1 – using a prolonged Stabilizing Plate and spacer, e.g. a second card.

13.2.24.3.3 Apparatus

Use a modified peel mechanism with an angled support plate (green) above the two rollers (grey) to limit the amount the card (blue) can bend and flex while the overlay (brown) is being peeled:



13.2.25 #8130#: Adhesion or Blocking [IS10373-1]

CQM Tag	#8130#
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CQM Test Method	13.2.25 #8130#: Adhesion or Blocking [IS10373-1]
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13.2.25.1 External Method:

Use the method "Adhesion or Blocking" defined in ISO/IEC 10373-1.

13.2.26 #8140#: Dynamic Bending Stress [IS10373-1]

CQM Tag	#8140#
CQM Test Method	13.2.26 #8140#: Dynamic Bending Stress [IS10373-1]
Changelog:	
After V2.19.1	Editorial changes only: minor editorial, note inserted alerting to changes in 2020 edition of 10373-1

13.2.26.1 External Method:

Use the method *ISO/IEC 10373-1 Dynamic bending stress*.



Note

Note that the test method defined in ISO/IEC 10373-1 was changed substantially with the 2020 edition.

13.2.27 #8150#: Dynamic Torsional Stress [IS10373-1]

CQM Tag	#8150#
CQM Test Method	13.2.27 #8150#: Dynamic Torsional Stress [IS10373-1]
Changelog:	
After V2.19.1	Editorial changes only:

13.2.27.1 External Method:

Use the method *ISO/IEC 10373-1 Dynamic torsional stress*.

13.2.28 #8160#: Impact Resistance ^[ISO7811-1]

CQM Tag	#8160#
CQM Test Method	13.2.28 #8160#: Impact Resistance [ISO7811-1]
Changelog:	
After V2.19.1	Editorial changes only:

13.2.28.1 External Method:

Use the method "Resistance to Impact defined in ISO/IEC 7811-1.

The location of the impact shall be either in the center of the card or in the area reserved for embossing.

Any items such as ICM or signature panel applied to the card after lamination may influence the result and placing these near the center of the impact should be avoided.

Metalized areas inside the card, such as antennae, can influence and invalidate the test result. If this is suspected, the embossing and inspection of test cards to ensure conformity with #4026# may be used alternatively.

CQM recommends to conduct this test on cards after lamination and punching and before the application of add-ons, ICM, etc. as the presence of these may influence and invalidate the result.

13.2.28.2 Report

Report the presence of damage at the impact location and the surrounding area.

13.2.29 #8170#: Corner Impact Test [ANSI NCITS 322 5.20]

CQM Tag	#8170#
CQM Test Method	13.2.29 #8170#: Corner Impact Test [ANSI NCITS 322 5.20]

The purpose of this test is to verify proper adhesion of the layers the card consists of in the corners of the card, which cannot be tested using the peel strength tests.

This is tested by exposing all corners of the card sequentially to a strong impact against a flat steel plate by holding the card in a heavy holder and letting it fall onto the flat steel plate.



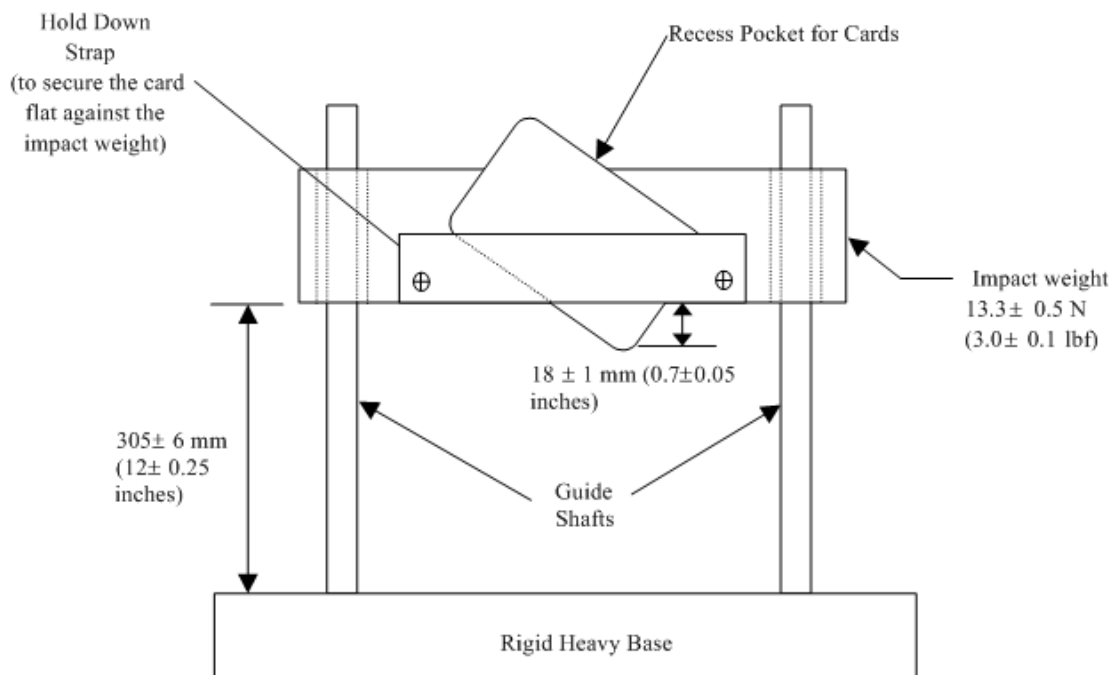
Note

The Corner Impact Test is not intended to simulate events that occur during a card's normal life. The Corner Impact test applies a strong force to the card's corner to check proper adhesion of the card's layers in the corners of the card. If for example the impacted corner breaks off without showing signs of delamination, the card is compliant.

13.2.29.1 Apparatus

The apparatus is defined in **Figure 23**.

Figure 23—Card Corner Impact Test Fixture – 5



13.2.29.2 Procedure

1. Mount the card in the impact weight as shown in **Figure 23**
2. Raise the impact weight to the specified height and let the impact weight fall.
3. The resulting impact typically permanently deforms the impacted corner into a local S-shape or similar.
4. Remove the test card and inspect the sides of the corner deformed by the impact for signs of delamination and/or fracture and record the observation of a delamination or fracture. Document the observation with photographs where useful.
5. Repeat the impact on the opposite corner.
6. Use a second, identical card to repeat the impact on the two remaining corners.



Note

The card will usually no longer fit into the holder when a corner adjacent to the one to be tested has been exposed to this test before. Hence 2 identical cards may be needed for this test and in such case from each card two opposite corners shall be tested such that in total all 4 different corners are tested.

13.2.29.3 Test Report

Report the extent of any delamination or fracture that occurred in and near the card corners deformed by the test.

13.2.30 #8190#: Resistance to Chemicals [IS10373-1, ISO 7810]

CQM Tag	#8190#
CQM Test Method	13.2.30 #8190#: Resistance to Chemicals [IS10373-1, ISO 7810]

The method determines adverse effects of a range of chemical contaminants on the card.

13.2.30.1 External Method:

Use the method "Resistance to Chemicals" defined in ISO/IEC 10373-1, but supersede the information given in the external method with the following information:

Carry out the exposure to salt mist for ICC and IAC.

Conformity to the following requirements shall be verified prior and after exposure as defined in **Table 13.2** :

Table 13.2—Requirements after Chemical Exposure

Requirement	Test Method
#3002#: Width and Height [IS7810]	#8030#
#3003#: Thickness outside Contacts, Embossed Areas and Add-on Areas [IS7810]	#8040#
#3007#: Overall Card Warpage [IS7810]	#8100#
#3058#: Solidity – Adhesion of ICM to Card	#8230#
#3025#: Magnetic Stripe – Dynamic Characteristics of a High Coercivity Magnetic Stripe [ISO7811-6]	ISO/IEC 10373-2
#4022#: Answer-to-Reset – 100% Test	Tbd by Vendor
#3061#: Verification of Antenna Functionality, and Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")	Tbd by Vendor
No significant changes to the visual appearance of the artwork or visual security features have occurred.	Visual inspection at 40 cm distance for 2 s with the unaided eye



Note

Changes in the visual appearance of the ICM not affecting functionality shall not be seen as a reason of non-compliance. Such changes include change of color of the base material or the encapsulant, but not significant oxidization or other chemical reaction of the contact metallization.

13.2.31 #8200#: Opacity

CQM Tag	#8200#
CQM Test Method	13.2.31 #8200#: Opacity
Changelog:	
After V2.19.1	Editorial changes only

13.2.31.1 External Test Method:

Use the method *ISO/IEC 10373-1 Opacity*

13.2.32 #8210#: 3 wheel Test

CQM Tag	#8210#
CQM Test Method	13.2.32 #8210#: 3 wheel Test

13.2.32.1 External Method:

Use the method "ICC – Mechanical strength: 3 wheel test for ICCs with contacts" defined in ISO/IEC 10373-1.



Note

In the versions of 10373-1 published prior to 2020, the downward movement of the center wheel is limited by the sentence: "The resulting downward movement of wheel W1 shall be limited, so that the distance between axis B in Figure C.2 and the surface of wheel W1 never becomes smaller than 3 mm."

This can cause problems with certain types of 3 Wheel test equipment, and certain cards.

Therefor this sentence shall be read as: "The resulting downward movement of wheel W1 shall be limited, so that the minimum distance between axis B in Figure C.2 and the surface of wheel W1 is between 4,0 mm and 4,5 mm."

Vendors are permitted to use equipment compliant with older versions of 10373-1 at their own risk.

13.2.33 #8220#: Mechanical Reliability: Wrapping Test

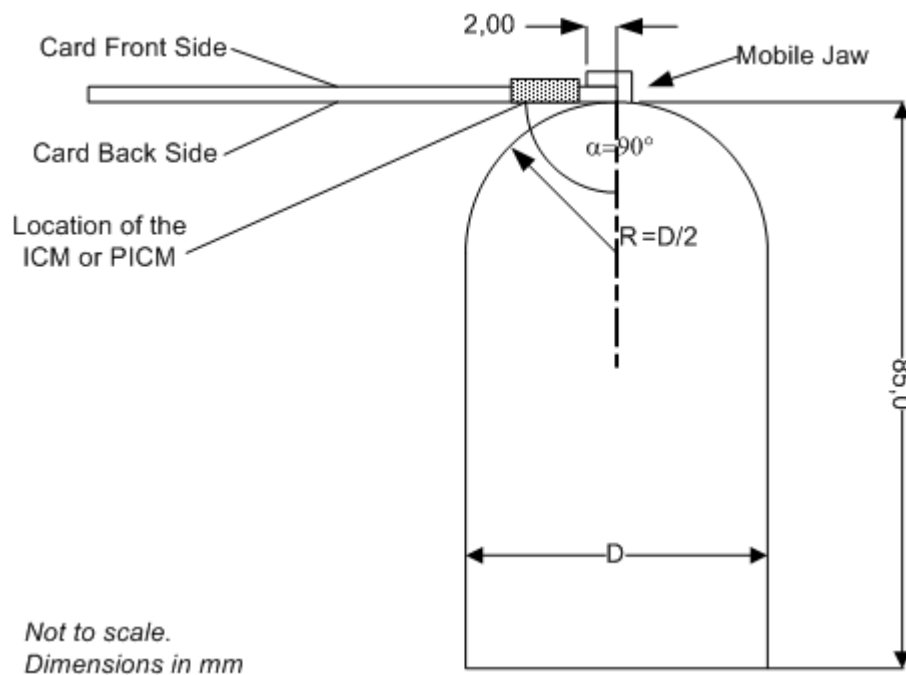
CQM Tag	#8220#
CQM Test Method	13.2.33 #8220#: Mechanical Reliability: Wrapping Test

The purpose of this test is to verify the mechanical robustness of the card by placing the card into the jaws of the test device, and wrapping major parts of the card around a metal cylinder with the diameter defined in the requirement.

13.2.33.1 Apparatus

The system shall be compliant with **Figure 24** below.

Figure 24—Apparatus for the Wrapping Test



Note

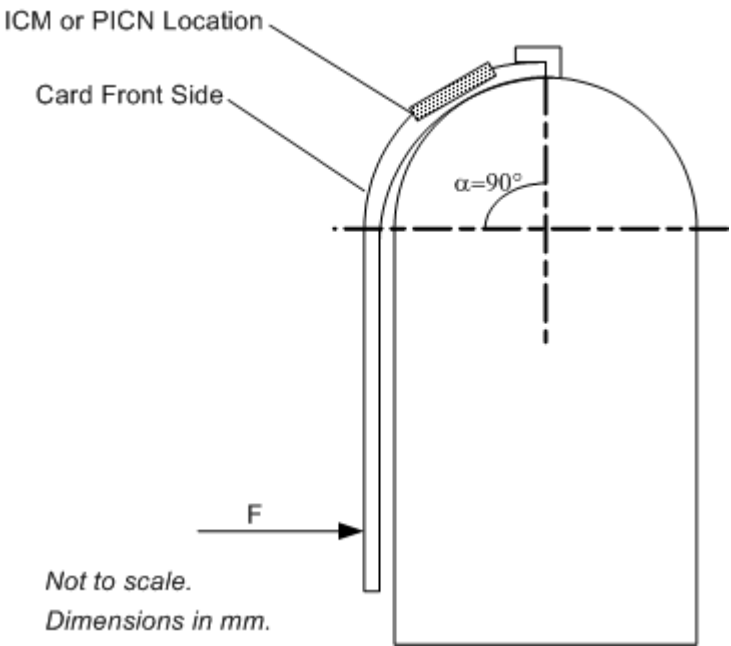
The rounded part of the apparatus is half a cylinder, not half a sphere.

The width of the apparatus shall be such that the card does not protrude over the edges of the rounded surface while being pressed against it.

13.2.33.2 Procedure

1. Pre-condition the sample.
2. Check that the IC in the Card is functional by verifying the ATR for Card with contact functionality and the ATS for Card with contactless functionality.
3. Insert the Card in the jaws front side up, the ICM being as close as possible to the jaw, but on the radius of the testing device, when wrapped.
4. Apply the number of wrapping cycles defined in the requirement, wrapping the card as shown in **Figure 25**. The time for deforming the card from a fully relaxed to a fully wrapped position shall be between 0.5 s and 2 s. The time for relaxing the card from a fully wrapped to a fully relaxed position shall be between 0.5 s and 2 s.
5. Repeat the same operation with the card inserted in the jaws back side up.
6. Check that the IC in the Card is functional by verifying the ATR for Card with contact functionality and the ATS for Card with contactless functionality.
7. For IAC, verify that any component connected to the ICM is still functional, and if the component is no longer functional, that the reason for this is failure of the component, and not a failure of the connection between the ICM and the Card.

Figure 25—Card under Wrapping Test



13.2.33.3 Test Report

The Test Report shall state the compliance or non-compliance of the samples to the requirement, and the diameters tested.

13.2.34 #8221#: Mechanical Reliability: Wrapping Test for IAC with a biometric sensor

CQM Tag	#8221#
CQM Test Method	13.2.34 #8221#: Mechanical Reliability: Wrapping Test for IAC with a biometric sensor
Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): New, imported from CSI, TM-CSI-Bio2.

The purpose of this test is to verify the mechanical robustness of the Card by placing the Card into the jaws of the test device and wrapping major parts of the card around a metal cylinder with the diameter defined in the requirement.

13.2.34.1 Apparatus

The apparatus shall be compliant with the apparatus defined in **13.2.33 #8220#: Mechanical Reliability: Wrapping Test**.

13.2.34.2 Procedure

In addition to exposing the card to the wrapping stress exposure defined in **13.2.33 #8220#: Mechanical Reliability: Wrapping Test** also expose the card to **13.2.33 #8220#: Mechanical Reliability: Wrapping Test** with the opposite short edge inserted into the clamp, with both the front and the backside facing up.

13.2.34.3 Test Report

The Test Report shall state the compliance or non-compliance of the samples to the requirement, and the diameters tested.

13.2.35 #8230#: Solidity – ICM Adhesion – Back of Card Spot Pressure Test

CQM Tag	#8230#
CQM Test Method	13.2.35 #8230#: Solidity – ICM Adhesion – Back of Card Spot Pressure Test
Changelog:	
After V2.22	Technical changes (incl. editorial changes): Clarified positioning of centre of pressure for multicentric ICM, for example combining ISO/IEC 7816-2 contacts and a fingerprint sensor into a single ICM.

This test is a destructive test with concentrated pressure on the exposed reverse side of the ICM, opposite to the ISO/IEC 7816-2 contacts. The test attempts pushing the ICM out of the card.

The force is applied directly to the center of the reverse side of the ICM through an opening in the card. The opening in the card is created specifically for this test.

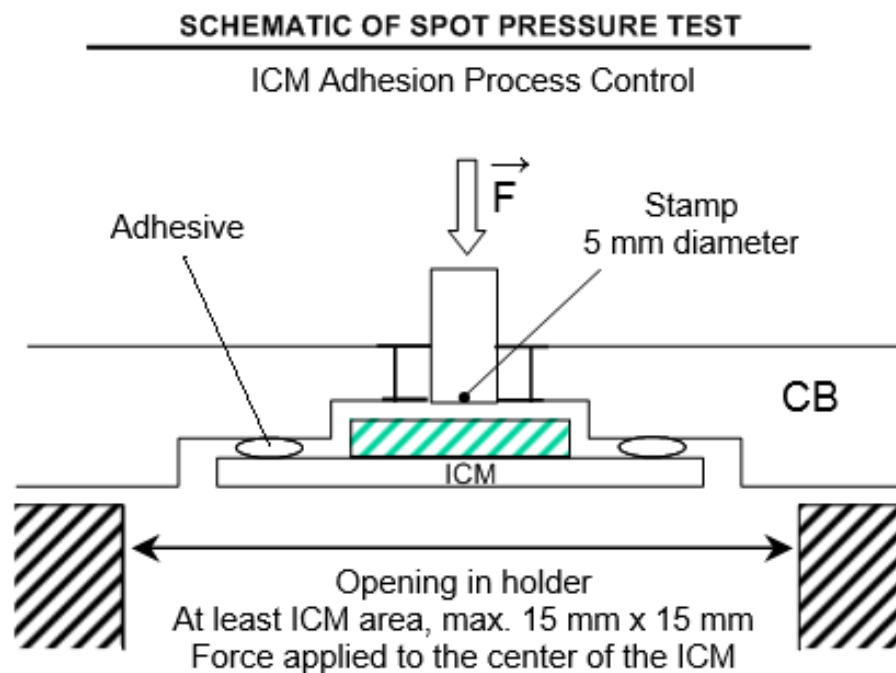
13.2.35.1 Apparatus

The apparatus consists of a card holder to hold the card in a fixed position. The card holder has an opening that is slightly larger than the visible surface of the ICM, to allow pushing the ICM from the card body when applying a force from behind.

The apparatus in addition has a stamp connected to a force measurement device. The stamp can move perpendicular to the card's surface and should be able to travel at least 5 mm deeper than the location of the card in the card holder.

The apparatus is shown in the following drawing:

Figure 26—Spot Pressure Test



Note

Minimum diameter for milled hole: Diameter of the Stamp + 1 mm

The test equipment used in this test shall conform to the schematic in [Figure 26](#).



Note

Certain recent ICM constructions have very small IC and a very small encapsulation around the IC. When embedding such ICM into cards, the resulting cavity to hold the IC may also be very small and then a stamp diameter of 5 mm may be too large, as it would not fit into the part of the cavity holding the IC. In such case stamps with a smaller diameter are permitted.

13.2.35.2 Procedure

1. Precondition sample
2. Check that the ICC meets the visual and dimensional requirements
3. Remove the card material covering the backside of the ICM that is not adhered to the ICM. Typically, this is the encapsulation of the IC and wire bonds (for wire bonded IC) or the backside of the IC itself (for flip-chip bonded IC). Use milling or cutting equipment as suitable for the specific card and ICM construction while taking care not to damage the adhesive between the ICM and the card.
4. Determine the center of the ICM. (reverse side)
5. Lower the stamp until it is close above the rear center of the ICM without touching the ICM or the card with the stamp.

6. Start the force measurement and continue lowering the stamp onto the rear of the ICM with a speed of less than 30 mm/min.
7. Continue the downward movement of the stamp until one of the following occurs:
 - The ICM detaches at least partially from the card
 - The ICM ruptures
8. Record the maximum force measured.
9. Remove the card and ICM from the test apparatus and observe the ICM and card for the failure mode of the adhesive and record the observation.

Failure modes recommended to distinguish are:

- ICM ruptured
- ICM detached from the adhesive
- Adhesive detached from the card
- Adhesive split (adhesive can be found on both the detached ICM and the card)

The test is expected to irreversibly damage the ICM, even if the test is stopped at the minimum required force. No verification of electrical functionality is required as part of this test and damage of the IC and ICM is likely to occur.

Rupture of the ICM is an indication for a strong adhesion of the ICM to the card and not necessarily a failure of this test. Rupture of the ICM at forces lower than the requirement can usually not be influenced by the embedding process.

Regular detachment of the adhesive from the card, without card material sticking to the adhesive, with the currently prevalent hotmelt technology, is an indication that the adhesive was not sufficiently activated during the ICM embedding process.

10. For ICM having multiple centers, for example an ICM that contains the EMV contact functionality and a fingerprint sensor, the test shall be conducted in each center of the ICM, for example the center of the IC on the backside of the ISO/IEC 7816-2 contacts, and in the center of the fingerprint sensor. Separate samples shall be used for each center.

13.2.35.3 Test Report

The test report shall report the maximum force measured and the failure mode.

13.2.36 #8250#: ESC – ESD Conductivity of Card

CQM Tag	#8250#
CQM Test Method	13.2.36 #8250#: ESC – ESD Conductivity of Card
Changelog:	

After V2.19.1	Technical changes (incl. editorial changes): Added contact scenarios 5 and 6 for cards to accommodate discharge path via fingerprint sensor and 7816-2 contacts, corrected table of contact scenarios for materials, clarified that each contact should be connected via 10 MOhm resistor to ground to avoid build up of residual charges on contacts that are floating during a contact scenario.
After V2.22	Editorial changes only: change of wording of permitted interval for calibration check to avoid misunderstanding.

The apparatus consists of:

- ESD pulse generator, compliant with IEC 61000-4-2.
- A contact grid comprising of a contact plate with distinct contact fields on the surface in accordance with **13.2.36.1**.
- A digital storage oscilloscope with a minimum bandwidth of 200 MHz
- A current probe with a minimum bandwidth of 60 MHz and a maximum pulse current rating of at least 250 A peak and a rise time of less than 6 ns.
- Means of integrating a current curve recorded by the oscilloscope

13.2.36.1 Contact Grid

The Test Grid shall consist of a non-conductive baseplate with 6 conductive contact areas on its surface.

The 4 outer contacts are arranged in a rectangular form around a central card position with two more center contacts touching the side of the card facing downwards, as illustrated in the two schematics below. The surface of the center contacts is located app 2 mm below the surface of the outer contacts:

Figure 27 - Contact arrangement without card

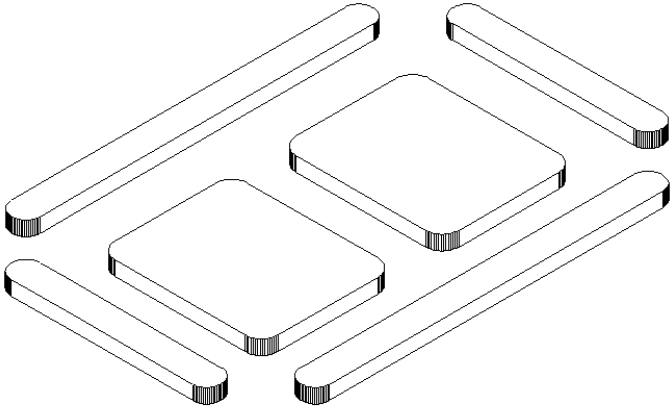
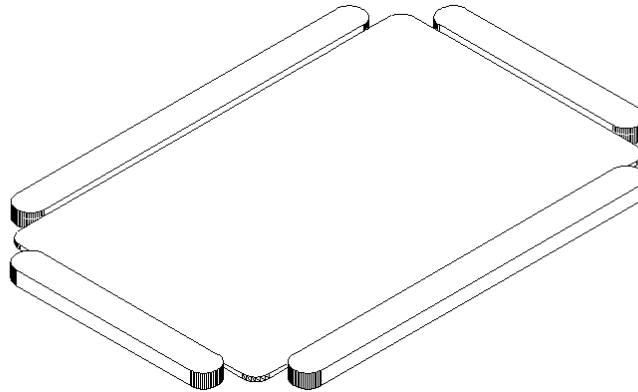
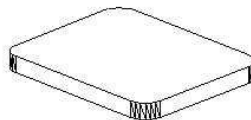


Figure 28 - Contact arrangement with card inserted



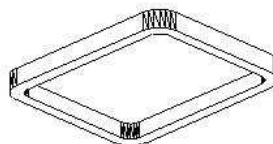
The contacts shall be made of metal and be 3 mm thick with a tolerance of ± 0.2 mm. Seen from the top the individual contacts shall be flat as shown in **Figure 29 - Top view of individual contact plate** :

Figure 29 - Top view of individual contact plate



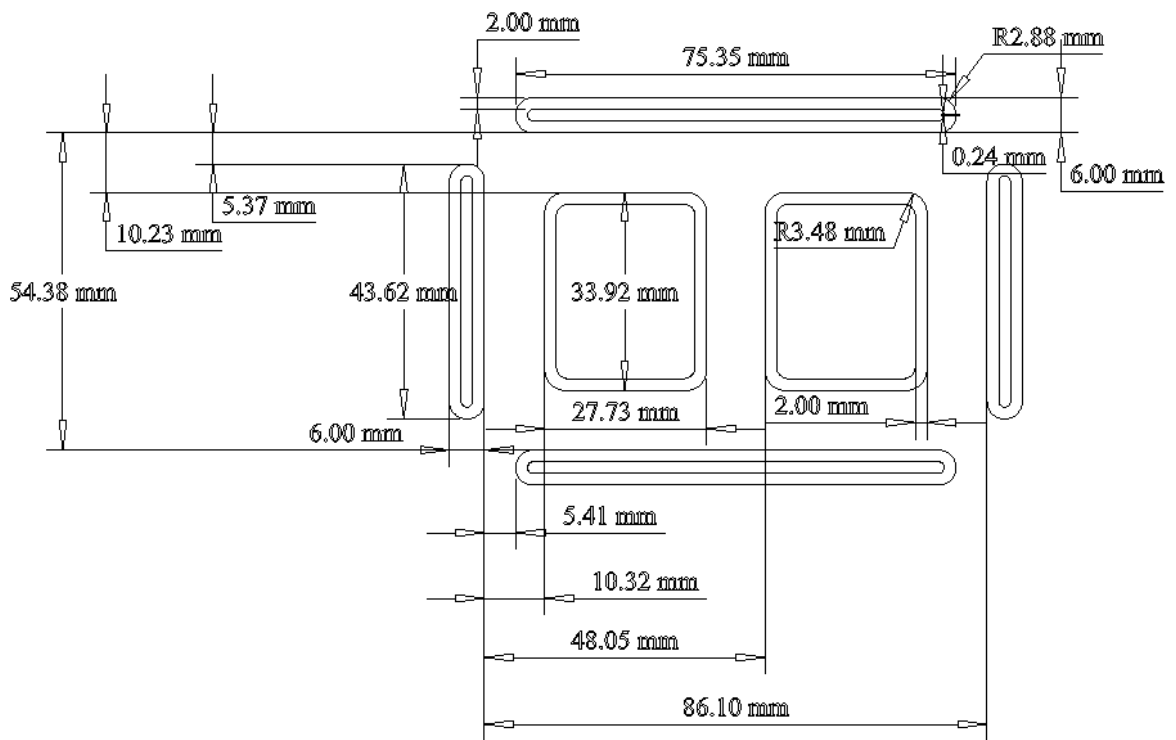
From the bottom the contacts shall be milled out to leave a remaining thickness of 0.5 mm in the center of the contact, with a 2 mm wide edge with the full 3 mm thickness as shown in **Figure 30 - Bottom - Top view of individual contact plate** :

Figure 30 - Bottom - Top view of individual contact plate



The horizontal and vertical dimensions of the contacts and their arrangement are defined in **Figure 31 - Contact plate measurements** :

Figure 31 - Contact plate measurements



Tolerance of the size of the contact plates shall be no larger than ± 0.02 mm. Tolerance of the positioning of the contact plates shall be ± 0.05 mm.

To accommodate the card, the 2 center contacts' top surfaces shall be 2 mm below the top surface of the 4 outer contacts.

Figure 32 - Cross section - center contacts with card shows a cross section through the centerline of the 2 center contacts parallel to the long edge of the card, with the card inserted:

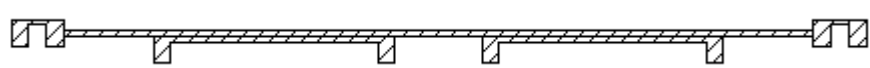
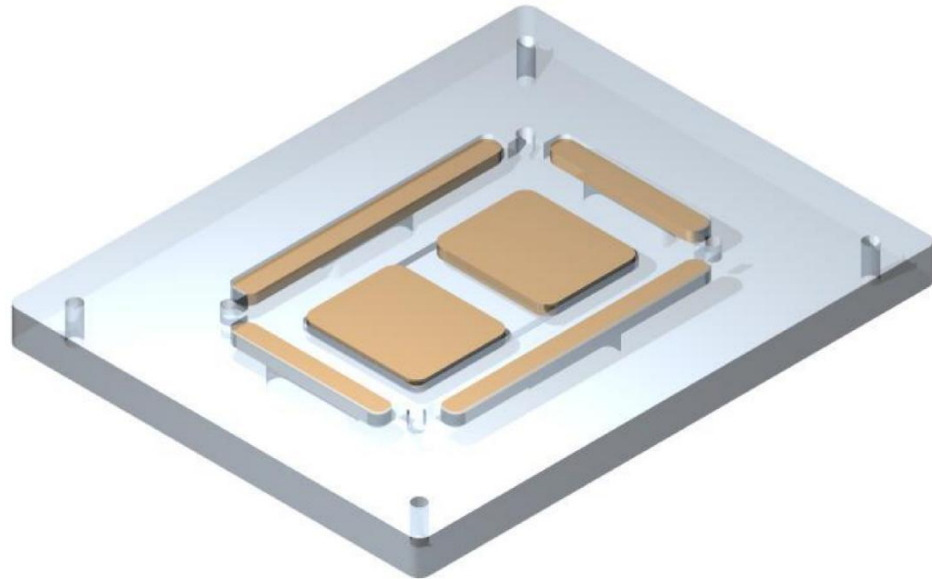


Figure 32 - Cross section - center contacts with card

If the card is warped a weight made of a non-conductive material should be used to flatten the card. The weight shall have a rectangular base 80 mm wide and 45 mm high and a mass of at least 300 g.

The contacts shall be fixed to a non-conductive base plate as shown in **Figure 33 - Baseplate with contacts** (base plate transparent, contacts in brown):

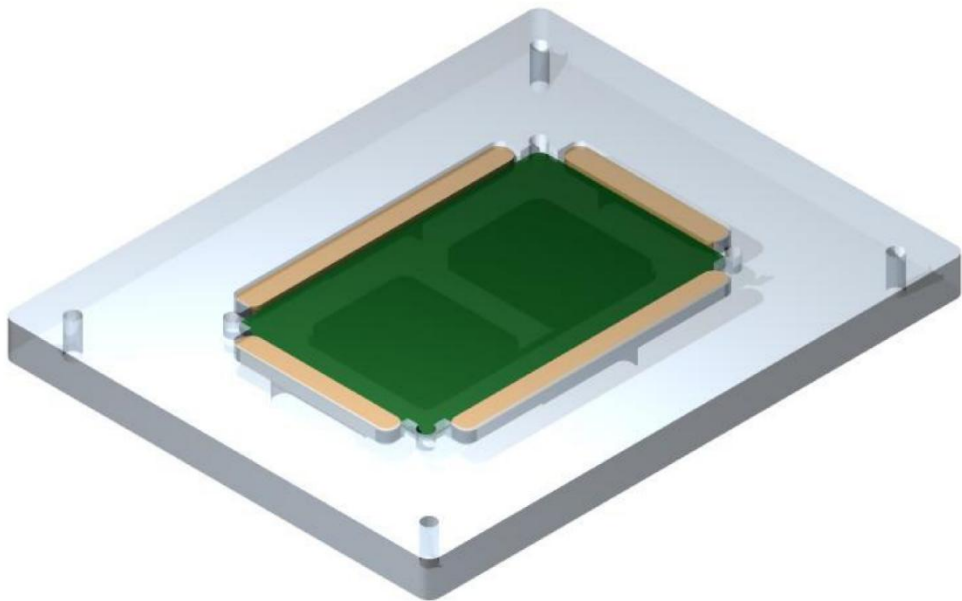
Figure 33 - Baseplate with contacts



The center contacts shall protrude from the base plate for app. 1 mm and the inner edges of the 4 edge contacts shall be fully exposed over their entire height of 3 mm.

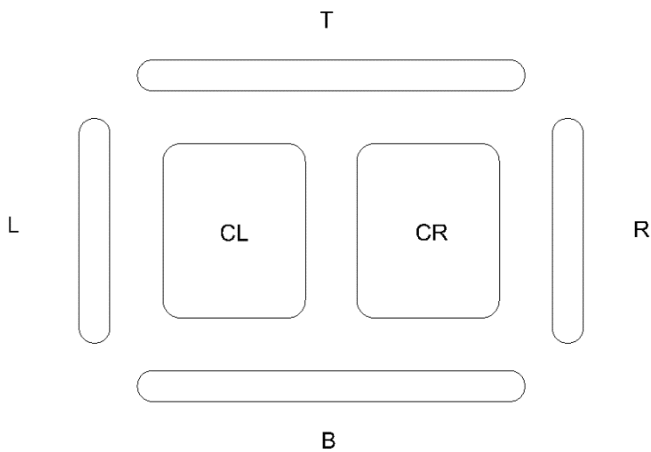
Figure 34 - Baseplate with card inserted shows the baseplate (transparent), the contacts (brown) and an inserted card (green):

Figure 34 - Baseplate with card inserted



The individual conductive areas of the Test Grid are subsequently referred to as “grid contacts” with identifiers as shown in **Figure 35 - Naming of the grid contacts** :

Figure 35 - Naming of the grid contacts



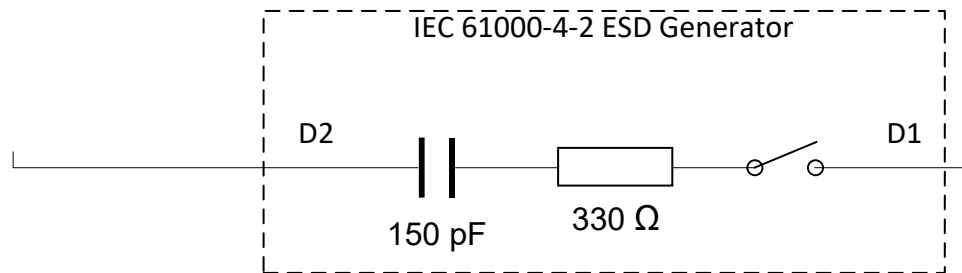
Electrical contact between the grid contact and the generator shall be made through cables connected to the bottom of each contact. The length of each cable between each individual contact and the connectors of the ESD Pulse Generator shall not exceed 0.5 m with the exception of the ESD generator's ground cable.

13.2.36.2 ESD Pulse Generator

The ESD pulse generator shall be compliant with IEC 61000-4-2 with integrated discharge detector.

The generator shall be operated in contact mode.

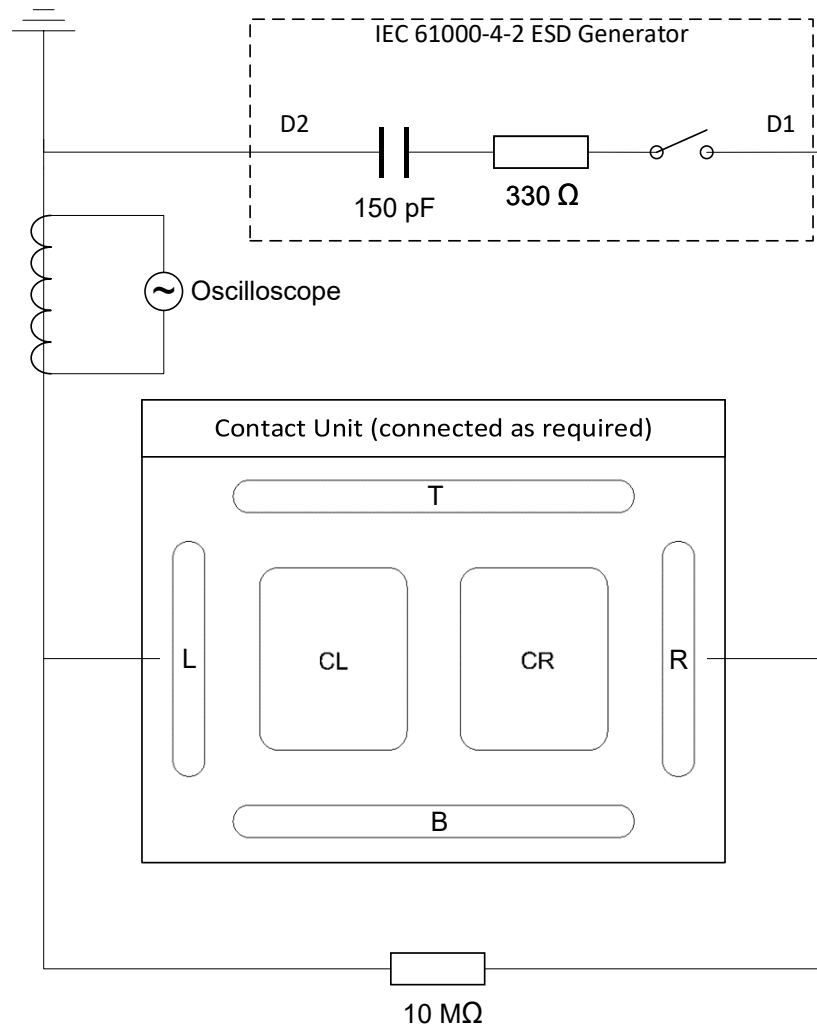
The ESD Pulse Generator is subsequently represented by the following schematic:



13.2.36.3 Electrical Interconnection

During testing the different elements shall be interconnected as shown in **Figure 36 - Electrical interconnection between ESD generator, contact grid and oscilloscope** :

Figure 36 - Electrical interconnection between ESD generator, contact grid and oscilloscope



To analyse the discharge energy transmitted by the card, a current probe and an oscilloscope are inserted into the test circuitry.

The current probe shall have a minimum bandwidth of 60 MHz and a maximum pulse current rating of at least 250 A peak and a rise time of less than 6 ns.

Note: A Tektronix P6021 complies with these specifications.

The Oscilloscope shall have a minimum bandwidth of 250 MHz, the ability to record the current measured with at least 2000 samples/μs and to either calculate the Integral of the current or export the data in a format that can be used for such calculation.

Each contact of the discharge grid shall be connected via a 10 MΩ resistor to ground to avoid the buildup of residual charges on contacts that are not connected to either D1 or D2 during a contact scenario.

13.2.36.4 Procedure

13.2.36.4.1 Introduction

This method uses a current probe and a digital oscilloscope to measure the actual charge transmitted by the card from one group of grid contacts into another in a range of scenarios.

To take account of capacitive and inductive effects of the test fixture, firstly a calibration run is made to determine a scale with 0% equivalent to only air being between the discharge electrodes and 100% equivalent to a conductor with 0 Ω resistance inserted between the electrodes.

To measure a card's conductivity, it is placed between the grid electrodes and the ESD is applied to one set of electrodes and is then conducted to some extent by the card to the grounded set of electrodes. The current flowing from the grounded set of grid contacts into ground is measured and recorded using the current probe connected to the oscilloscope.

A range of grid contact combinations is tested. To ensure each of the measurements is on a scale from 0% to 100%, the selected grid contact combination is firstly calibrated to 0% when open and 100% when shortened before the measurement is made with the card between the grid contacts.

From the recording of the discharge curve the transmitted charge is calculated and expressed as a percentage between 0% and 100% at a certain Discharge Voltage.

If no Discharge Voltage is specified by the requirement standard or applicable specification, set the Discharge Voltage to 8 kV.

13.2.36.4.2 Measurement

Set up the apparatus as defined in [13.2.36.3](#). Set the oscilloscope to a maximum of ± 40 A and such that it will record the discharge from at least 100 ns before to at least 500 ns past the beginning of the discharge. The beginning of the discharge shall be defined as the first time the current exceeds 2 A.

Set the ESD pulse generator to the Discharge Voltage, contact discharge with a contact discharge tip.

Connect the grid contacts of the test fixture as defined for the first scenario in Table 2 – Contact Scenarios.

Leaving the card out of the test fixture, discharge the generator. Record the current curve with the current probe and integrate the current curve. The result is the charge Q0%:

$$Q0\% = \sum_{t=-100ns}^{t=500ns} It * \Delta t$$

where It is the current recorded at a certain point in time t and Δt is the time interval at which the oscilloscope records the individual value It . Δt shall be no greater than 2 ns.

Connect the discharge electrode of the ESD generator directly to one of the contacts connected to GND and discharge the generator. Record the current curve with the current probe and Oscilloscope and integrate the current curve. The result is the charge Q100%:

$$Q100\% = \sum_{t=-100ns}^{t=500ns} It * \Delta t$$

Now reconnect the ESD generator as defined in **Table 3 – Grid Contact Scenarios for Cards and Card Shaped Components** for this scenario and place the card between the grid contacts.

Discharge the ESD generator and record the current flowing through the card and the grounded grid contacts with the current probe and the oscilloscope. Integrate the current curve to calculate the "absolute charge" Q_n conducted through the card (n is defined in **Table 3 – Grid Contact Scenarios for Cards and Card Shaped Components**):

$$Q_n = \sum_{t=-100ns}^{t=500ns} It * \Delta t$$

Now calculate the "relative charge" $Q_n\%$ from Q_n , $Q0\%$ and $Q100\%$ as follows:

$$Q_n\% = \frac{Q_n - Q0\%}{(Q100\% - Q0\%)}$$

If $Q_n\%$ is negative, $Q_n\%$ shall be 0 As.

Repeat the above sequence for each contact scenario defined in **Table 3 – Grid Contact Scenarios for Cards and Card Shaped Components**, keeping in mind that scenario 7 is only applicable if the card contains a biometric sensor on the back of the card, that is on the opposite of the side containing the ISO/IEC 7816-2 contacts:

Table 3 – Grid Contact Scenarios for Cards and Card Shaped Components

Sample:				Voltage:			
Contact Scenario				Result			
n	Contacts connected to electrode D1	Contacts connected to electrode D2		Q0%	Q100%	Qn	Qn%
			Card Side facing CL, CR	nAs	nAs	nAs	%
1	L	R	Front				

ID-1 Test Methods – Test Methods applicable to the components IL, CB, ICC, iacIL, and IAC
CB, ICC and IAC – Test Methods applicable for ISO/IEC 7810 ID-1 shaped devices

2	T	B	Front				
3	L	CR	Front				
4	B	CL, CR	Back				
5	CL	CR	Front				
6	CL	CR	Back				
7	Biometric sensor exposed on back of card	CR	Front				
Calibration Check Q100%: 1080 nAs < Q100% < 1320 nAs							
Calibration Check Q0%: Q0% < 120 nAs							
Note – If the card has IC contacts, the IC contacts shall be above contact CR when the front of the card faces downwards, identified as "Front; and above CL when the front of the card faces upwards, identified as "Back" in the results table. If the card has a magnetic stripe, the card shall be positioned such that the stripe is close to the T grid contact and in the "Back" orientation the magnetic stripe shall touch the center contacts.							

13.2.36.5 Calibration Check

To ensure proper functioning of the various components of the test apparatus, the following checks shall be made for every Q0% and Q100% measured.

Q100%:

This check verifies the proper functioning of the ESD generator, the current probe and oscilloscope.

1. Verify that the measured ESD charge Q100% is the nominal charge of the specified ESD generator's capacitance $\pm 10\%$.
2. The charge Q of a capacitor is:

$$Q = C * U$$

Where C is the capacitance of the capacitor and U is the voltage.

3. For the required IEC 61000-4-2 ESD Pulse generator the nominal charge of the capacitor is:

$$Q = 150 \text{ pF} * 8 \text{ kV} = 1200 \text{ nAs}$$

Q0%:

This check verifies the test apparatus for cross talk and leakage currents.

1. Verify that the measured ESD charge Q0% is less than 10% of the nominal charge of the specified ESD generator's capacitor.

13.2.36.6 Report

Report the Discharge Voltage, and for each Contact Scenario the calibration Charges Q0% and Q100%, and the relative Charge Qn% and if the calibration charges fall within the permitted limits

13.2.37 #8260#: ESC – ESD Conductivity of Materials

CQM Tag	#8260#
CQM Test Method	13.2.37 #8260#: ESC – ESD Conductivity of Materials

This test method is very similar to #8250# and mostly refers to it while defining only the differences here.

13.2.37.1 Apparatus

The apparatus is identical to the one defined in #8250#.

13.2.37.2 Procedure

The sample shall be cut into ID-1 card shape, if possible. The sample shall then be inserted into the test grid like a card.

If the dimensions of the sample are smaller than the width of an ISO/IEC 7810 ID-1 card, the sample may be cut into a square with the side length being that of the height of an ID-1 card. In such case Contact Scenario 1 shall be skipped and Contact Scenario 2 executed twice with the sample turned 90 ° for the second time.

The procedure is otherwise identical to the one defined in #8250#, but only the scenarios defined in Table 4 - Grid Contact Scenarios for Materials shall be tested.

Table 4 - Grid Contact Scenarios for Materials

Sample:				Voltage:			
Contact Scenario				Result			
	Contacts connected to electrode D1	Contacts connected to electrode D2		Q0% nAs	Q100% nAs	Qn nAs	Qn% %
1	L	R	n/a				
2	T	B	n/a				
3	CL	CR	Back				
4	CL	CR	Front				
Calibration Check Q100%: 1080 nAs < Q100% < 1320 nAs							

Calibration Check Q0%: Q0% < 120 nAs	
--------------------------------------	--

13.2.37.3 Test Report

Report the Discharge Voltage, and for each Contact Scenario the calibration Charges Q0% and Q100%, and the relative Charge Qn%.

13.2.38 #8270#: Advanced 3 wheel Test

CQM Tag	#8270#
CQM Test Method	13.2.38 #8270#: Advanced 3 wheel Test
Changelog:	
After V2.19.1	Technical changes (incl. editorial changes): Incorporating CSI TM-CSI-Bio1

13.2.38.1 Introduction



Note

To improve readability of this requirement, the subsequent text only mentions IAC, but the reader shall understand the term "IAC" to refer to IAC, and ICC produced using inlays already containing the IC, so illCC.

The purpose of this test is to determine the mechanical robustness of an Interactive Card ("IAC") by moving the IAC cyclically between three steel wheels rolling over Mechanically Sensitive Areas ("MSA"s) such as areas containing a display, an IC or ISO/IEC 7816-2 contacts.



Note

This test may not be relevant for MSAs with an area of less than 2 mm².

13.2.38.2 Default Requirement

Every MSA on an IAC shall be robust against local mechanical stress as it typically occurs during processing, personalization, and normal use of the card.

Unless specified differently by the relevant requirement, the card shall comply with the following:

To ensure this, every MSA on the card shall pass the following requirement, unless otherwise specified by a separate requirement:

- 3 wheel test with 8 N force for 2x50 cycles, horizontally and vertically

And every MSA on the card is highly recommended to pass the following requirement, unless otherwise specified by a separate requirement:

- 3 wheel test with 10 N force for 2x50 cycles, horizontally and vertically during monitoring, and
- 3 wheel test with 12 N force for 2x50 cycles, horizontally and vertically during qualification.
- IAC are required to be subjected to the above 3 wheel test, and the result reported, even though compliance is not required.
- IAC shall be, in addition, subjected to 3 wheel test with 15 N force for 2x50 cycles, horizontally and vertically during qualification, and the result reported, even though compliance is not required.

13.2.38.3 Acronyms and Definitions

<i>IAC</i>	InterActive Card - A card that contains built in devices that allow interaction with the card holder without the help of a card reading device, e.g. push buttons, displays, LEDs, typically but not necessarily containing a battery.
<i>Display</i>	Display – a device on a card that can display information that can change over time, the content of the information shown being controlled by electronics inside or outside of the card.
<i>MSA</i>	Mechanically Sensitive Area – an area of the card that might be significantly more sensitive to mechanical stress than the plastic card body, an area where local mechanical stress might cause failure of the card.
<i>Horizontal</i>	The direction parallel to the long edges of the card
<i>Vertical</i>	The direction parallel to the short edges of the card

13.2.38.4 Test locations and directions

The test shall be carried out over every MSA. MSAs shall at least include:

- Every display
- Every integrated circuit inside the card with an area of more than 2 mm²
- ISO/IEC 7816-2 contact areas
- Mechanical push buttons
- Biometric sensors

The test shall be conducted in horizontal and vertical direction.

The plane through the centers of the 3 wheels shall coincide with the horizontal or vertical centerline of the MSA, depending on the direction of the test.

13.2.38.5 Apparatus

The principle of the apparatus is shown in **Figure 37 – 3 wheel test principle**. The principle comprises three wheels, one above and two below the IAC. The IAC is moved cyclically between the three wheels, so that the MSA is repeatedly exposed to the forces exerted by the wheels.

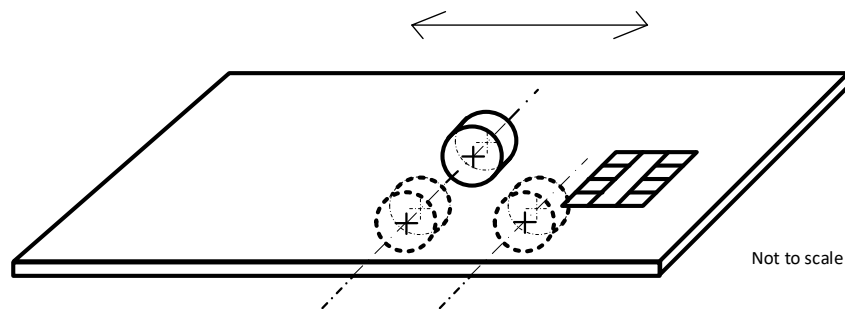


Figure 37 – 3 wheel test principle

The apparatus shall comprise three wheels mounted as shown in [Figure 38](#). Wheels W2 and W3 are fixed. Wheel W1 can move in the direction perpendicular to the surface of the IAC with a maximum error of $\pm 5^\circ$ and applies a force F_{W1} in the direction shown in [Figure 38](#) to the surface of the IAC. The force F_{W1} shall be applied by means of a static weight (in contrast to the dynamic stress that would be applied by a spring, stepper motor or pneumatic cylinder) fixed above wheel W1 such that the force direction shall pass through the axis of wheel W1. The resulting downward movement of wheel W1 shall be limited, so that the minimum distance between axis B in [Figure 38](#) and the surface of wheel W1 is between 4.0 mm and 4.5 mm.

The magnitude of the force F shall be as defined by the requirement or, if the requirement does not define a value, $8.0\text{N} \pm 0.5\text{N}$.

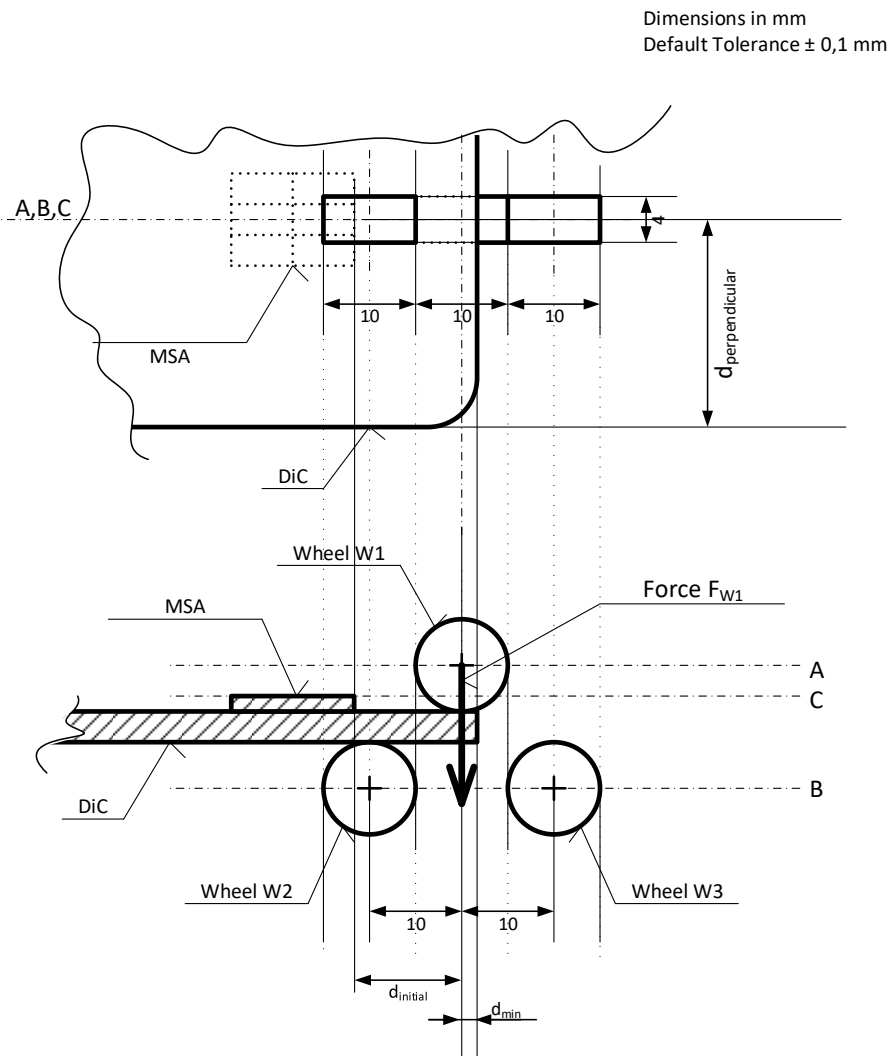


Figure 38 - Location of the wheels and initial position of the IAC

The method by which the IAC is held in position shall be such that it does not prevent deformation of the IAC during testing around the MSA. To achieve this the distance between the area of the IAC touched by the wheel W1 during testing, and any device holding the card during the test shall be at least 20 mm in the direction of Axis A and 10 mm perpendicular to the direction of Axis A.

The wheels shall have a standard chamfer and run on low-friction bearings, e.g. ball bearings.



Note

The following ball bearing definitions define suitable wheels: ISO 623ZZ, e.g. "radiospares" ref=747-721 or NMB=DDR 1030 ZZ RAS or AISI440C.

The part of the IAC moving over W2 shall be free to bend.

Dimension $d_{initial}$, defined in **Figure 38 - Location of the wheels and initial position of the IAC**, shall be such that the distance between the edge of the MSA closest to wheel W1, and the area where wheel W1 touches the surface of the IAC in the initial position, is at least 10 mm, provided that the wheel W1 remains on the IAC's surface. Should the wheel W1 leave the IAC's surface when positioned at a distance $d_{initial}$ from the edge of the MSA, then $d_{initial}$ shall be adjusted such that the initial position of wheel W1 is at the distance d_{min} from the edge of the IAC. Distance d_{min} shall be $1\text{ mm} \pm 1\text{ mm}$.

The dimension $d_{perpendicular}$, which is the distance between the edge of the card and the plane through the centers of the 3 wheels, defined by the axes A and B, shall not differ from the distance between the IAC's edge and the geometric center of the MSA by more than 1,0 mm during the test.



Note

When testing for example ISO/IEC 7816-2 contacts, based on an IAC having minimum contacts as defined in ISO/IEC 7816-2, dimension $d_{perpendicular}$ would be:

Contact side facing upwards: 22.62 mm for an IAC with 6 contacts and 23.89 mm for an IAC with 8 contacts.

Contact side facing downwards: 31.36 mm for an IAC with 6 contacts and 30.09 mm for an IAC with 8 contacts.

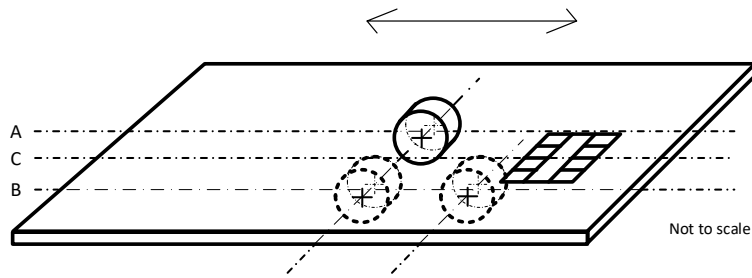


Figure 39 – Location of Axes A, B, and C

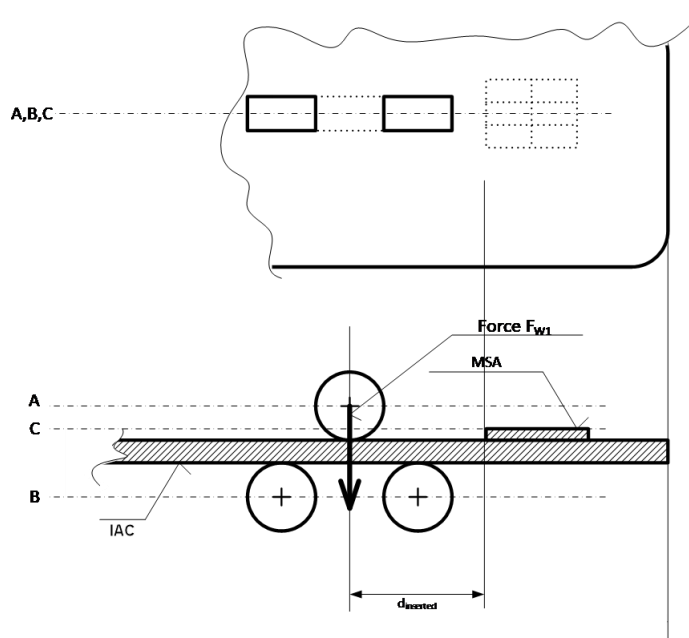


Figure 40 – IAC in fully inserted position

Dimension $d_{inserted}$, defined in **Figure 40 – IAC in fully inserted position** shall be such that the distance between the edge of the MSA closest to wheel W1, and the area where wheel W1 touches the surface of the IAC in the initial position, is at least 10 mm, provided that the wheel W1 remains on the IAC's surface. Should the wheel W1 leave the IAC's surface when positioned at a distance $d_{inserted}$ from the edge of the MSA, then $d_{inserted}$ shall be adjusted such that the initial position of wheel W1 is at the distance d_{min} from the edge of the IAC. Distance d_{min} shall be $1\text{ mm} \pm 1\text{ mm}$.

The stroke of the apparatus shall be adjusted such that it moves the card between the wheels such that at the initial position the wheel W1 touches the surface of the IAC at a distance $d_{initial}$ from the inner edge of the MSA and at the fully inserted position at a distance $d_{inserted}$ from the outer edge of the MSA. Hence the stroke of the apparatus shall be:

$$d_{initial} + \text{width of the MSA} + d_{inserted}$$

Note: The 'inner edge of the MSA' is the edge that gets inserted first into the wheel arrangement; the 'outer edge' is the edge that gets inserted last into the wheel arrangement.

13.2.38.6 Test Positions

Determine the MSAs of the IAC. The MSAs shall include:

- Display
- Each IC with an area of more than 4 mm²

For each MSA determine the geometrical center:

- For an MSA visible on the surface determine the geometrical center of the visible part of the MSA
- For an MSA not visible on the surface determine the geometrical center of the component from the specification

Determine the 2 axes C for each MSA:

- The horizontal axis through the geometrical center of the MSA
- The vertical axis through the geometrical center of the MSA

13.2.38.7 Procedure

During all movements inside the apparatus as described below, the speed of the IAC shall not exceed 100 mm/s.

During all movements the angle between axis C and the plane defined by axis A and axis B shall not exceed 2°.

For each MSA and Axis C of the MSA, conduct the following procedure:

- a. Pre-condition the sample IAC.
- b. Verify that the IAC is fully functional.
- c. Insert the IAC into the apparatus in the initial position with the MSA facing upwards as shown in **Figure 38 - Location of the wheels and initial position of the IAC**.
- d. Move the IAC within the apparatus into the inserted position as shown in **Figure 40 – IAC in fully inserted position**.
- e. Withdraw the IAC to the initial position.

NOTE Steps c) to e) are defined as one cycle.

- f. Repeat c) to e) for a total number of cycles defined by the requirement with a frequency of $0.5 \text{ Hz} \pm 0.2 \text{ Hz}$. or, if the requirement does not define the number of cycles, for 50 cycles.
- g. Insert the IAC into the apparatus in the initial position, but with the contacts facing downwards. Note, that the apparatus typically requires re-adjustment so that the axes A and B, and Axis C are in the same plane after the IAC is turned over.
- h. Move the IAC within the apparatus into the inserted position.
- i. Withdraw the IAC to the initial position.
- j. Repeat g) to i) with a frequency of $0.5 \text{ Hz} \pm 0.2 \text{ Hz}$ for a total number of cycles defined by the base standard; or, if the base standard does not define the number of cycles, for 50 cycles.
- k. Check if the IAC remains fully functional as intended and if the MSA shows any visible indication of damage and note the result.

13.2.38.8 Test Report

The report shall state if the IAC remains fully functional as intended.

13.2.39 #8280#: Resistance of a Display to Local Impact

CQM Tag	#8280#
CQM Test Method	13.2.39 #8280#: Resistance of a Display to Local Impact

13.2.39.1 Introduction

The purpose of this test is to determine the mechanical robustness of a display inside an Interactive Card ("IAC") by dropping a steel ball with a defined impact energy onto the display and checking the display for damages.

13.2.39.2 Default Requirement

Every display visible on the surface of the card shall resist a local impact with a kinetic energy of 10 mJ by a steel ball of a diameter of 10 mm.

13.2.39.3 Apparatus

Rigid level base plate with at least the size of a IAC.

Steel ball with a diameter of 10 mm.

The steel ball is dropped onto the center of the MSA from a height defined in the requirement.

The kinetic energy of the steel ball at the moment of impact onto the MSA's surface depends on the drop height and is approximately:

Impact Height [m]	Kinetic Energy [mJ]
0.05	2.03
0.1	4.06
0.15	6.09
0.2	8.12
0.25	10.15
0.3	12.17

13.2.39.4 Procedure

Place the card on the rigid level base plate.

Drop the steel ball from a height defined in the requirement onto the geometrical center of each MSA 3 times. Then check if the IAC remains fully functional and check the MSA for visual damages, such as:

- On displays: cracks, black spots.

13.2.39.5 Test Report

Report:

- The exact weight of the steel ball.
- The height the steel ball is dropped from.
- If the IAC remains fully functional after the impact, including ability of any contained display to show all relevant characters.
- For each MSA, if any visual defects like black spots or cracks are visible and if they are, document them adequately, e.g. through photographs.

13.2.40 #8290#: Resistance of a Fingerprint Sensor against Pressure

CQM Tag	#8290#
CQM Test Method	13.2.40 #8290#: Resistance of a Fingerprint Sensor against Pressure
Changelog:	
After V2.19.1	New: Adopted from CSI method TM-CSI-Bio5



Note

This method is under development. Please report experiences with this method, suggestions for improvement, and alternative similar methods to CQM Maintenance.

13.2.40.1 Introduction

The purpose of this test is to determine the mechanical robustness of a fingerprint sensor implemented into an IAC against pressure applied onto the fingerprint sensor's active surface.

13.2.40.2 Apparatus

A rigid level flat surface to position the card on.

A spherical tip with a diameter of 8 mm and a hardness between 40 and 55 (Shore A), capable of applying pressure perpendicular to the card surface, attached to a dynamometer capable of measuring the force the spherical tip is applying over a range between 5 N and 50 N with an accuracy of ± 1 N, and a device to move the spherical tip and the dynamometer up and down perpendicular to the card surface at a speed of 100 mm/minute.



Note

Compliant tips are available as FP2-1032 (non conductive) or FP2C-1032 (conductive) from www.normantool.com.

13.2.40.3 Procedure

Verify that the Fingerprint Sensor is compliant with #2043#: Functional Verification of Biometric Sensors.

Place the card onto the rigid level flat surface such that the spherical tip applies its force to the center of the active area of the fingerprint sensor.

Use the dynamometer and the movement device to move the spherical tip onto the active area of the fingerprint sensor with a speed of 100 mm/minute until the required force is reached.

Apply the required force onto the fingerprint sensor for 5 s.

Then remove the spherical tip from the fingerprint sensor with a speed of 100 mm/minute until the spherical tip is fully removed from the fingerprint sensor.

Verify that the Fingerprint Sensor remains compliant with #2043#: Functional Verification of Biometric Sensors.

Repeat the application of force using the spherical tip for the required number of cycles and with the required force values as specified by the requirement.

13.2.40.4 Test Report

Report:

- The exact type of spherical tip used
- The number of cycles and the forces applied

- If the card is compliant with #2043#: Functional Verification of Biometric Sensors at the beginning of the test and after each force application cycle.

13.2.41 #8291#: Resistance of a Fingerprint Sensor against repeated Pressure

CQM Tag	#8291#
CQM Test Method	13.2.41 #8291#: Resistance of a Fingerprint Sensor against repeated Pressure
Changelog:	
After V2.19.1	New: Adopted from CSI method TM-CSI-Bio5



Note

This method is under development. Please report experiences with this method, suggestions for improvement, and alternative similar methods to CQM Maintenance.

13.2.41.1 Introduction

The purpose of this test is to determine the mechanical robustness of a fingerprint sensor implemented into an IAC against repeated pressure applied onto the fingerprint sensor's active surface.

13.2.41.2 Apparatus

A rigid level flat surface to position the card on.

A spherical tip with a diameter of 8 mm and a hardness between 40 and 55 (Shore A), capable of applying pressure perpendicular to the card surface, attached to a dynamometer capable of measuring the force the spherical tip is applying over a range between 5 N and 50 N with an accuracy of ± 1 N, and a device to move the spherical tip and the dynamometer up and down perpendicular to the card surface at a speed of 500 mm/minute.



Note

Compliant tips are available as FP2-1032 (non conductive) or FP2C-1032 (conductive) from www.normantool.com.

13.2.41.3 Procedure

Verify that the Fingerprint Sensor is compliant with #2043#: Functional Verification of Biometric Sensors.

Repeat the below procedure for the required number of cycles:

- Place the card onto the rigid level flat surface such that the spherical tip applies its force to the center of the active area of the fingerprint sensor.

- Use the dynamometer and the movement device to move the spherical tip onto the active area of the fingerprint sensor with a speed of 500 mm/minute until the required force is reached.
- Apply the required force onto the fingerprint sensor for 0.5 s to 1 s.
- Then remove the spherical tip from the fingerprint sensor with a speed of 500 mm/minute until the spherical tip is fully removed from the fingerprint sensor.

Verify that the Fingerprint Sensor remains compliant with #2043#: Functional Verification of Biometric Sensors.

Repeat the application of force using the spherical tip for the required number of cycles and with the required force values as specified by the requirement.

13.2.41.4 Test Report

Report:

- The exact type of spherical tip used
- The number of cycles and the forces applied
- If the card is compliant with #2043#: Functional Verification of Biometric Sensors at the beginning of the test and after each group of force application cycles.

13.2.42 #8300#: Resistance of a Fingerprint Sensor against Abrasion

CQM Tag	#8300#
CQM Test Method	13.2.42 #8300#: Resistance of a Fingerprint Sensor against Abrasion
Changelog:	
After V2.19.1	New: Adopted from CSI method TM-CSI-Bio7



Note

This method is under development. Please report experiences with this method, suggestions for improvement, and alternative similar methods to CQM Maintenance.

13.2.42.1 Introduction

The purpose of this test is to determine the mechanical robustness of a fingerprint sensor implemented into an IAC against Abrasion of the active surface.

13.2.42.2 Apparatus

A Norman Tool RC A Abrasion Wear Tester 7-IBB with a 175 g load, or equivalent.



Note

Please consult with Mastercard's CSI team regarding the use of an equivalent wear tester.

13.2.42.3 Procedure

Place the card into the Wear tester such that the center of the active area of the Fingerprint Sensor is exposed to the abrasant.

Run the required number of abrasion cycles.

Verify that the Fingerprint Sensor remains compliant with #2043#: Functional Verification of Biometric Sensors at the beginning and the end of the test

13.2.42.4 Test Report

Report:

- The wear tester used
- The type of abrasant used
- The number of cycles and the pressure used
- Compliance with #2043#: Functional Verification of Biometric Sensors at the beginning and the end of the test

13.2.43 #8310#: Resistance of a Fingerprint Sensor against Scratching

CQM Tag	#8310#
CQM Test Method	13.2.43 #8310#: Resistance of a Fingerprint Sensor against Scratching
Changelog:	
After V2.19.1	New: Adopted from CSI method TM-CSI-Bio8
After V2.22	Technical changes (incl. editorial changes): More detail added about how to conduct test.



Note

This method is under development. Please report experiences with this method, suggestions for improvement, and alternative similar methods to CQM Maintenance.

13.2.43.1 Introduction

The purpose of this test is to determine the mechanical robustness of a fingerprint sensor implemented into an IAC against Scratching of the active surface.

13.2.43.2 Apparatus

According to ASTM 3363.5H

13.2.43.3 Procedure

Verify that the Fingerprint Sensor remains compliant with #2043#: Functional Verification of Biometric Sensors at the beginning and the end of the test.

Acquire a fingerprint and determine its level of quality. To reduce the influence of random effects on the level of quality, CQM recommends acquiring the fingerprint 20 times and average the level of quality. This approach is highly recommended especially if the entity conducting the test does not have access to the numerical quality values of the level of quality and must conduct the test as a go/no-go test.

Following ASTM D3363.5H and using a pencil with a hardness of 5H, create the following scratches on 2 samples each:

- Horizontal
- Vertical
- Diagonal

The recommended force is 7.35 ± 0.1 N.

Acquire the same fingerprint again and determine its level of quality using the same number of acquisitions and method of averaging as used prior to exposure.

13.2.43.4 Test Report

Report:

- For each sample the type of scratch applied, the quality of the fingerprint prior and post scratching, and compliance with #2043#: Functional Verification of Biometric Sensors at the beginning and the end of the test.

Part F

Requirements and Test Methods for Personalizer

14 Personalization – ID-1 Product Requirements

This chapter defines the Product Requirement for the personalization of ID-1 sized products, such as CB, ICC, IAC, pICC, IAC.

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Note

Definition: Personalization is the allocation of the product to a single person so that only that person can use it.

After personalization, the product is ready for its first payment and it can be assumed that it conforms to all the requirements for which it received a Letter of Approval.

Personalization may be:

- Reversible or irreversible
- Temporary or permanent
- Visually and machine legible or machine legible only

The personalization of ID1 is irreversible and visually and machine legible.

This document does not define the Personalization requirements for other product types.

14.1 Graphic Personalization

14.1.1 Embossing

14.1.1.1 #4001#: Embossing – Card Dimensions after Embossing [IS7810]

CQM Tag	#4001#		
CQM Requirement	14.1.1.1 #4001#: Embossing – Card Dimensions after Embossing [IS7810]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Embossing		
Test Method	IS10373-1		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		

The width and height of the embossed card shall conform with the requirement "Card dimensions and tolerances", dimensions of an "ID-1 Returned Card", as defined in ISO/IEC 7810.

The embossing equipment and its settings can influence the conformity of a card to these requirements. Therefor monitoring shall include samples from each embossing machine.

If during qualification of the personalized card the vendor determines and documents that the width and height of the embossed card conforms with the requirement "Card dimensions and tolerances", dimensions of an "ID-1 Unused Card", as defined in ISO/IEC 7810, then the monitoring for this requirement is not required.

14.1.1.2 #4002#: Embossing – Location of the Embossed Characters [ISO7811-1, [CDS]]

CQM Tag	#4002#		
CQM Requirement	14.1.1.2 #4002#: Embossing – Location of the Embossed Characters [ISO7811-1, [CDS]]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production

Applicable to CQM Products	- Graphical Personalisation using Embossing
Test Method	The Vendor shall define a suitable Test Method
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 8
CQM Monitoring	1 item every Set-up.

The location of the embossed characters shall conform to the requirements in ISO/IEC 7811-1 and [CDS].

14.1.1.3 #4003#: Embossing – Dimensions of the Embossed Characters ^[ISO7811-1]

CQM Tag	#4003#		
CQM Requirement	14.1.1.3 #4003#: Embossing – Dimensions of the Embossed Characters [ISO7811-1]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Embossing		
Test Method	MachSuppCert		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The font wheels used to emboss characters shall enable embossing of the card such that the resulting characters on an imprinted paper form conform to the requirements defined in ISO/IEC 7811-1.

14.1.1.4 #4004#: Embossing – Embossed Character Relief Height ^[ISO7811-1]

CQM Tag	#4004#		
CQM Requirement	14.1.1.4 #4004#: Embossing – Embossed Character Relief Height [ISO7811-1]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Embossing		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Week.		
Changelog:			
After V2.19.1	Technical changes (incl. editorial changes): note added permitting sample PANs with one example, editorial changes		

The embossed character's relief height shall conform to the requirements defined in ISO/IEC 7811-1 for an unused card. Verification shall be done with an accuracy of ± 0.01 mm or better.



Note

For testing purposes somewhat realistic sample PANs like 5188 0000 0000 0000 are permitted.



Note

Calipers are usually not accurate enough to achieve the required accuracy. A micrometer with a stand, or a thickness indicator with a flat tip should be used.



Note

ISO/IEC 7811-1 defines two different embossed character height ranges, one for the PAN, one for the other information. Both ranges shall be checked.

14.1.1.5 #4005#: Embossing – Color of Tipping

CQM Tag	#4005#		
CQM Requirement	14.1.1.5 #4005#: Embossing – Color of Tipping		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Embossing		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Set-up.		

Tipping of embossed data is optional, but recommended. If present, it shall conform to [CDS].

14.1.1.6 #4006#: Embossing – Adhesion of Tipping

CQM Tag	#4006#		
CQM Requirement	14.1.1.6 #4006#: Embossing – Adhesion of Tipping		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Embossing		
Test Method	#9010#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

The tipping color on the embossed characters shall resist to peeling forces, as described in #9010#: Durability of Tipping.

In addition to the required monitoring, conformity with this requirement shall be verified again after any of the following changes:

- Overlay the tipping foil is applied to
- Tipping foil (different color, new reel of same color)

- Embossing settings
- Tipping parameters

14.1.1.7 #4007#: Embossing – Embossed Character Relief Height Retention under Pressure

[ISO7811-1]

CQM Tag	#4007#		
CQM Requirement	14.1.1.7 #4007#: Embossing – Embossed Character Relief Height Retention under Pressure [ISO7811-1]		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Embossing		
Test Method	#9020#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		

The relief height of the embossed characters after having been subjected to pressure as described in **#9020#: Embossed Character Relief Height Retention: Pressure** shall comply with the requirement "Relief height of embossed characters" for "Returned cards" defined in ISO/IEC 7811-1.

Product family-based sampling is recommended.

14.1.1.8 #4008#: Embossing – Embossed Character Relief Height Retention under Heat

[ISO7811-1]

CQM Tag	#4008#		
CQM Requirement	14.1.1.8 #4008#: Embossing – Embossed Character Relief Height Retention under Heat [ISO7811-1]		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Embossing		
Test Method	#9030#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		

The relief height of the embossed characters shall not degrade by more than 10% after having been subjected to heat as described in **#9030#: Embossed Character Relief Height Retention: Heat**.

Product family-based sampling is recommended.

14.1.2 Thermal Transfer

14.1.2.1 #4009#: Thermal Transfer Printing - Integrity of Characters

CQM Tag	#4009#		
CQM Requirement	14.1.2.1 #4009#: Thermal Transfer Printing - Integrity of Characters		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Thermal Transfer		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

Information reproduced via thermal transfer shall conform to the requirements in [CDS].

The Vendor shall ensure the integrity of the information reproduced via thermal transfer.

14.1.2.2 #4010#: Thermal Transfer Printing - Durability

CQM Tag	#4010#		
CQM Requirement	14.1.2.2 #4010#: Thermal Transfer Printing - Durability		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Thermal Transfer		
Test Method	#9040#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 5		
CQM Monitoring	None required		

A protective overlay shall be applied on top of any thermal transfer printed personalized information, as required in [CDS], subject to the following conditions:

The card thickness with the protective overlay applied shall conform to the applicable requirements (see section **9.1.3 #3003#: Thickness outside Contacts, Embossed Areas and Add-on Areas [IS7810]** and section **9.1.4 #3004#: Thickness within Add-on Areas**).

- The added protective overlay shall not affect the card's functionality,
- Peel-strength of the added protective overlay shall comply with section **9.1.19 #3015#: Solidity – Peel Strength of the Overlay [IS7810]** , with a minimum force of 0.25 N/mm;
- The added protective overlay shall not cover any part of the hologram or the signature panel.

The information reproduced via thermal transfer, with the overlay applied, shall remain legible after exposure to abrasion forces as defined in #9040#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand:

Method ID	Method Name	Number of cycles
#9041#	Sandpaper Rub Test	5
#9042#	Soft Eraser Rub Test	5
#9043#	Tape Pull Test	1



Note

Contactless cards intended for Thermal Transfer personalization are subject to specific requirements. See #3040#: Suitability of the IL, ICC, and IAC for Visual Personalization.

14.1.3 Indent Printing

14.1.3.1 #4011#: Indent Printing - Appearance and Intensity

CQM Tag	#4011#		
CQM Requirement	14.1.3.1 #4011#: Indent Printing - Appearance and Intensity		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	<ul style="list-style-type: none"> - Graphical Personalisation using Indent Printing - Graphical Personalisation of the CVC2 using Indent Printing 		
Test Method			
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

Indent printing on the rear of the card shall be visible but should not be easily legible when looking at the front of the card with the bare eyes at 40 cm distance within 2 seconds under normal lighting conditions.

When defining the check, the vendor shall consider, that premature vanishing of the CVC2 is a loss of functionality, while the visibility of the ghosting of the CVC2 on the front of the card is primarily a cosmetic, and hence less critical issue.



Note

This document does NOT define a requirement prohibiting that the indent print on the rear of the card is visible when looking at the front of the card ("ghosting"). Experiments have shown that if indent printing is done too lightly to avoid 'ghosting' on the front, the indent printed characters are more likely to wear off prematurely.

14.1.3.2 #4012#: Indent Printing - on the Front of the Card – Conformity to Card Design Standards

CQM Tag	#4012#		
CQM Requirement	14.1.3.2 #4012#: Indent Printing - on the Front of the Card – Conformity to Card Design Standards		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Indent Printing		

Test Method	The Vendor shall define a suitable Test Method
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 1
CQM Monitoring	1 item every Set-up.

Indent printing on the front shall conform to the requirements in [CDS].

14.1.3.3 #4013#: Indent Printing - Location of Printed Characters on Signature Panel

CQM Tag	#4013#		
CQM Requirement	14.1.3.3 #4013#: Indent Printing - Location of Printed Characters on Signature Panel		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Indent Printing - Graphical Personalisation of the CVC2 using Indent Printing		
Test Method			
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

The location of characters reproduced via indent printing on the signature panel shall follow the requirements in [CDS].

Any indent printing shall be at a visible distance from an ICM.

Indent printing near an antenna may be applied if the indent printing is located within the area specified by the CB, ICC manufacturer as suitable for mechanical personalization or embossing.

Indent printing shall not interfere with any function of the card, e.g. the contact or contactless functionality.

14.1.3.4 #4014#: Indent Printing - Color of Printed Characters

CQM Tag	#4014#		
CQM Requirement	14.1.3.4 #4014#: Indent Printing - Color of Printed Characters		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Indent Printing - Graphical Personalisation of the CVC2 using Indent Printing		
Test Method			
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

Indent-printed characters on the rear of the card shall be black.

14.1.3.5 #4015#: Indent Printing - Integrity of Characters

CQM Tag	#4015#		
CQM Requirement	14.1.3.5 #4015#: Indent Printing - Integrity of Characters		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Indent Printing - Graphical Personalisation of the CVC2 using Indent Printing		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

The integrity of the characters reproduced via indent printing shall be ensured.

14.1.3.6 #4016#: Indent Printing - Durability

CQM Tag	#4016#		
CQM Requirement	14.1.3.6 #4016#: Indent Printing - Durability		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Indent Printing		
Test Method	#9040#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Month.		

The characters produced by indent printing shall remain legible after exposure to abrasion forces as defined in #9040#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand: for the number of cycles specified in the table below:

Method ID	Method Name	Number of cycles
#9041#	Sandpaper Rub Test	5
#9042#	Soft Eraser Rub Test	5
#9043#	Tape Pull Test	1



Note

The vendor is permitted to use dedicated sample cards to conduct these tests. The vendor is not required to use production cards for this test, as long as the indent printed surface of the sample cards is representative of the surface of the production cards.

14.1.4 Laser Engraving

14.1.4.1 #4017#: Laser Engraving – Visual Appearance

CQM Tag	#4017#		
CQM Requirement	14.1.4.1 #4017#: Laser Engraving – Visual Appearance		
Applicable to Entity	Vendor	Subcontractor	

Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Laser Printing		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Set-up.		

The information produced by laser engraving shall conform to the requirements in [CDS].

14.1.4.2 #4018#: Laser Engraving – Durability

CQM Tag	#4018#		
CQM Requirement	14.1.4.2 #4018#: Laser Engraving – Durability		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Laser Printing		
Test Method	#9040#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		

The information produced by laser engraving shall remain legible after exposure to abrasion forces as defined in #9040#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand:

Method ID	Method Name	Number of cycles
#9041#	Sandpaper Rub Test	5
#9042#	Soft Eraser Rub Test	5
#9043#	Tape Pull Test	1

14.1.5 Drop-on-Demand Printing

14.1.5.1 #4029#: Drop-on-Demand Printing – Visual Appearance

CQM Tag	#4029#		
CQM Requirement	14.1.5.1 #4029#: Drop-on-Demand Printing – Visual Appearance		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Drop-on-Demand or Inkjet Printing		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 1		
CQM Monitoring	1 item every Set-up.		

The information produced by Drop-on-Demand Printing shall conform to the requirements in [CDS].

14.1.5.2 #4030#: Drop-on-Demand Printing – Durability

CQM Tag	#4030#		
CQM Requirement	14.1.5.2 #4030#: Drop-on-Demand Printing – Durability		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Drop-on-Demand or Inkjet Printing		
Test Method	#9040#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	None required		

The information produced by Drop-on-Demand Printing shall remain legible after exposure to abrasion forces as defined in #9040#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand:

Method ID	Method Name	Number of cycles
#9041#	Sandpaper Rub Test	5
#9042#	Soft Eraser Rub Test	5
#9043#	Tape Pull Test	1

14.2 Functional Personalization

14.2.1 Magnetic

14.2.1.1 #4019#: Magnetic Encoding Characteristics

CQM Tag	#4019#		
CQM Requirement	14.2.1.1 #4019#: Magnetic Encoding Characteristics		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Personalizing the Magnetic Stripe		
Test Method	IS10373-2		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Set-up.		

The encoding process characteristics shall comply with ISO/IEC 7811-6. At least the following parameters shall be verified:

- Bit density
- Signal amplitude
- Location of start sentinel
- Jitter

14.2.1.2 #4020#: Magnetic Encoding Characteristics – Location of Magnetic Tracks

CQM Tag	#4020#		
CQM Requirement	14.2.1.2 #4020#: Magnetic Encoding Characteristics – Location of Magnetic Tracks		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Personalizing the Magnetic Stripe		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Week.		

The magnetic encoding characteristics shall comply with ISO/IEC 7811-6. At least the following parameter shall be verified on a regular basis for all personalization equipment:

- Location of magnetic tracks

Test method: To check the location of the magnetic tracks, the use of a 'magnetic developer' and either a template showing the required minimum track dimensions, or a measurement device capable of measuring the distance between a card's edge and a magnetic track, is recommended.

If the vendor opts to measure only one edge of a magnetic track, the vendor shall consider the width of the actually encoded track adequately, because usually the actual encoded track width does not allow for the full tolerance range for one edge of the track to be utilized. For example, if the upper edge of track 2 is shifted to the upper tolerance limit, the lower edges of track 1 and track 2 are unlikely to reach their minimum distance from the upper edge.

The Vendor is permitted to opt for longer monitoring intervals than specified above, but then the vendor shall measure and control the location of the tracks against tighter requirements (Control Limits) and the vendor shall demonstrate that the controls are sufficient to keep the location of the magnetic tracks within the specified range, the "Specification Limits". A successful demonstration requires that during periodic controls no values were measured outside of the Specification Limits during the preceding 6 months.

Independent of the length of the monitoring interval, the vendor shall control the location of the magnetic tracks after any repair or maintenance work on the personalization equipment that may have influenced the location of the magnetic tracks.

14.2.2 Electric

14.2.2.1 #4032#: Personalization Profile (Specification, Change control)

CQM Tag	#4032#		
CQM Requirement	14.2.2.1 #4032#: Personalization Profile (Specification, Change control)		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production

Applicable to CQM Products	
Test Method	The Vendor shall define a suitable Test Method
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 1
CQM Monitoring	None required

The vendor shall manage Personalization Profiles properly to ensure that only cards with compliant and approved personalization are issued, and that all changes are reviewed and qualified by the relevant parties.

Personalization Profiles shall define at least:

- The ICC, including IC and all software items;
- Data content, format, and structure;
- Method and details of the graphical personalization, such as locations and colors;
- Other relevant information to ensure the personalized product is supplied as necessary, such as carrier, packaging, envelopes, inserts, shipping method, as applicable.

The vendor shall fully specify the personalization profile, using means adequate to the personalization systems the vendor uses. This specification may be stored in plain language, or in a machine-readable format. The vendor's personalization profile specification shall be the result of a well-defined, systematic process.

The vendor shall qualify the new Personalization Profile specification through multiple, discreet actions:

- The vendor shall validate the vendor's personalization profile specification against all the applicable requirements, including those issued by Mastercard, and those provided by the issuer.
- The vendor shall subject the Personalization Profile to the approval processes required by Mastercard, e.g. CPV.
- The vendor shall provide personalized samples as requested to the issuer, and, should the issuer not request any samples, enquire if samples are needed.
- In any case, the vendor shall await approval of a Personalization Profile from the issuer before shipping cards personalized using that new Personalization Profile.

If the Personalization Profile changes, then the Vendor shall:

- Consider the risk resulting from the change, considering the requirements for approval by external entities, including but not limited to the rules of Mastercard's CPV process;
- Ensure the modified Personalization Profile is subject to the required approval steps, e.g. those required by MasterCard, e.g. CPV;
- Clarify with the Issuer if the Issuer wants to receive samples for qualification testing of the Personalization Profile, and submit these samples to the Issuer;

- In any case, the vendor shall await approval of a modified Personalization Profile from the Issuer before shipping cards personalized using that modified Personalization Profile.

All these activities shall follow well defined procedures and the resulting approvals shall be documented as quality records.

Only cards personalized using a fully qualified and approved Personalization Profile shall be sent out by the Vendor for issuance.

14.2.2.2 #4021#: Electric Encoding Characteristics

CQM Tag	#4021#		
CQM Requirement	14.2.2.2 #4021#: Electric Encoding Characteristics		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Personalize via the Contact Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 2		
CQM Monitoring	1 item every Batch.		

The electrical personalization shall be carried out in accordance with [EMVK], [CPSP] and the requirements agreed between the issuer and the personalization vendor, as verified during the CPV of the personalized card.

The Vendor shall verify the correct electrical personalization using an adequate test tool:

- Software and configuration of the test tool shall be current;
- Test profiles shall be defined in the test tool that correspond to, and can distinguish between, the different Perso Profiles the vendor uses to personalize cards;
- Test profiles shall be developed and qualified together with a Personalization Profile;
- Information shall be provided to the personnel conducting the test, so it is clear which test profile shall be used to verify a specific Personalization Profile.



Note

To ensure that software and configuration of the test tool is current, the Vendor should develop and implement a process to monitor the software releases for the test tool, to ensure that test configurations and test scripts are updated to properly operate with a new software release, and that the new software and the required test configurations and test scripts work properly before releasing the updated software to production.

14.2.2.3 #4022#: Answer-to-Reset – 100% Test

CQM Tag	#4022#		
CQM Requirement	14.2.2.3 #4022#: Answer-to-Reset – 100% Test		
Applicable to Entity	Vendor	Subcontractor	

Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Personalize via the Contact Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	100% control required		

The ICC-P shall comply with **5.2.11 #2018#: Answer-to-Reset ("ATR")**.

14.2.3 Electromagnetic

14.2.3.1 #4023#: Electromagnetic Encoding Characteristics

CQM Tag	#4023#		
CQM Requirement	14.2.3.1 #4023#: Electromagnetic Encoding Characteristics		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Personalize via the Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Batch.		

The electromagnetic personalization shall be carried out in accordance with [EMVL], [CPSP] and the requirements agreed between the issuer and the personalization vendor, as verified during the CPV of the personalized card.

The Vendor shall verify the correct electromagnetic personalization using an adequate tool, including verifying the electromagnetic personalization via the contactless interface.

14.2.3.2 #4031#: Risk Management of Co-Existence of Antenna and Mechanical Personalization

CQM Tag	#4031#		
CQM Requirement	14.2.3.2 #4031#: Risk Management of Co-Existence of Antenna and Mechanical Personalization		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Personalize via the Contactless Interface		
Test Method	Specification review		
Default CQM Q-Plan:			
CQM Qualification	No testing required, product specification shall state conformity. Conformity shall be achieved by construction.		
CQM Monitoring	None required		

The personalization vendor has the option to prove to Mastercard that by construction a certain ICC family cannot be affected by mechanical personalization such that the

antenna becomes damaged by the personalization process, e.g. by breaking the antenna wire by embossing into its location.



Note

The personalization vendor typically proves this to Mastercard by proving this during the CQM Audit to the CQM Auditor's satisfaction.

If the vendor successfully proves to Mastercard that by construction a certain ICC cannot be affected by mechanical personalization such that the antenna becomes damaged, then the vendor is not required to comply with **#4024#: Verification of contactless functionality after Mechanical Personalization – Sampling Test**.

To prove this the vendor shall consider all factors influencing the location of the antenna inside the ICC, including at least the following:

- Size and geometry of the antenna, considering the maximum possible dimension resulting from the machine settings and tolerances of the antenna creating process;
- Location of the antenna on/in the IL, including the positioning tolerances of placing the antenna onto/into the IL;
- Size and size tolerances of the IL, including those that may result from processing of the IL, e.g. like processing into a prelam;
- Positioning tolerances of positioning the prelam into the stack of plastic layers for card lamination;
- Dimensional changes resulting from the card lamination process;
- Accuracy of the card punching process.

The above values shall be based either on measurements over reasonable periods of time, or other reproducible and well-defined information, and not for example on a single lot or unfounded assumptions about tolerances, and shall constitute a realistic representation of the tolerances occurring in the supply chain leading to the finished ICC.

From this information the vendor shall calculate a zone which is certain to be free of the antenna and in which mechanical personalization could be conducted without potentially damaging the antenna. By considering **#2805#: Antenna Design**, the vendor shall determine the area of the card which is suitable for mechanical personalization, subsequently referred to as the 'Safe Mechanical Personalization Area'

The Vendor shall document the 'Safe Mechanical Personalization Area' in accordance with **#2810#: Inlays and cards containing inlays – Specification of Personalization Restrictions** and provide this information to the subsequent vendors in the supply chain.

The personalization vendor shall demonstrate to Mastercard that the personalization vendor's processes ensure that mechanical personalization is restricted to the 'Safe Mechanical Personalization Area', as specified for the ICC that is being personalized, considering tolerances in the personalization process such as positioning tolerances inside the embossing machine.

See **#BE00# Verification of contactless functionality after mechanical personalization – relationship of CQM requirements** for additional information how the various requirements for verifying contactless functionality after personalization interrelate.

14.2.3.3 #4024#: Verification of contactless functionality after Mechanical Personalization – Sampling Test

CQM Tag	#4024#		
CQM Requirement	14.2.3.3 #4024#: Verification of contactless functionality after Mechanical Personalization – Sampling Test		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Personalize via the Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	3 items every Batch.		

This requirement is applicable if:

- a vendor, while testing personalized cards for conformity with #4024#, has never detected a failure for a certain card construction, and
- the underlying card construction is known to be compliant with **#2805#: Antenna Design – Minimum distance between mechanical personalization areas and the antenna** or **#2807#: Antenna Design non-compliant with #2805# – Card Embossability**, and supporting evidence for compliance is available to the personalization Vendor.

The card shall comply with **5.3.17 #2035#: Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")**.

This sampling-based approach is only permitted as long as the personalizer does not identify ICC-P with failure of the contactless function after mechanical personalization (Indent, Embossing).

A personalizer who has identified ICC-P with failure of the contactless function after mechanical personalization shall comply with **#4025#: Verification of contactless functionality after Mechanical Personalization – 100% Test** for the affected product permanently, at least until measures have been taken and proven effective to ensure no further failures can occur.



Note

A personalizer who identifies, while attempting to comply with #4024#, any antenna failure after mechanical personalization like embossing or indenting, shall permanently switch to a 100% test of the contactless functionality following mechanical personalization for the affected product according to #4025# instead, at least until measures have been taken and proven effective to ensure no further failures can occur.

See **#BE00# Verification of contactless functionality after mechanical personalization – relationship of CQM requirements** for additional information how the various requirements for verifying contactless functionality after personalization interrelate.

14.2.3.4 #4025#: Verification of contactless functionality after Mechanical Personalization – 100% Test

CQM Tag	#4025#		
CQM Requirement	14.2.3.4 #4025#: Verification of contactless functionality after Mechanical Personalization – 100% Test		
Applicable to Entity	Vendor		Subcontractor
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Personalize via the Contactless Interface		
Test Method	The Vendor shall define a suitable Test Method		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	100% control required		

This requirement becomes applicable if:

- a vendor, while testing personalized cards for conformity with #4024#, detects a failure for a certain card construction, or
- a card construction is not known to be compliant with **#2805#: Antenna Design – Minimum distance between mechanical personalization areas and the antenna** nor with **#2807#: Antenna Design non-compliant with #2805# – Card Embossability**, or no evidence for compliance is available to the personalization vendor.

The card shall comply with **5.3.17 #2035#: Answer-to-Select ("ATS") or Answer-to-reQuest ("ATQ")**.



Note

A personalizer who identifies, while attempting to comply with #4024#, any antenna failure after mechanical personalization like embossing or indenting, shall switch permanently to a 100% test of the contactless functionality following mechanical personalization for the affected product according to #4025# instead of #4024#, at least until measures have been taken and proven effective to ensure no further failures of the antenna can occur during personalization.

See **#BE00# Verification of contactless functionality after mechanical personalization – relationship of CQM requirements** for additional information how the various requirements for verifying contactless functionality after personalization interrelate.

14.3 Mechanical Integrity

The following requirements are defined to help that mechanical personalization does not cause unacceptable deformation or damage to the card.

14.3.1 #4026#: Absence of Residual Stress

CQM Tag	#4026#		
CQM Requirement	14.3.1 #4026#: Absence of Residual Stress		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products	- Graphical Personalisation using Embossing		
Test Method	#9050#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Batch.		

No cracks or signs of brittleness shall be visible in the zones where the card has been indent printed or embossed.

The test shall be performed on samples taken from regular personalization runs.

14.3.2 #4027#: Overall Card Warpage of Personalized ICC

CQM Tag	#4027#		
CQM Requirement	14.3.2 #4027#: Overall Card Warpage of Personalized ICC		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products			
Test Method	#8100#		
Default CQM Q-Plan:			
CQM Qualification	Minimum Sample Size: 8		
CQM Monitoring	1 item every Shift.		

The maximum distance from a flat rigid plate to any portion of the ICC-P placed on the plate shall not exceed 2.5 mm including the ICC-P thickness.

The vendor shall ensure that all CB construction are monitored at the required frequency.

Monitoring of ICM based ICC-P is not required if the ICC was produced from CB and ICM through milling and embedding.

Test Method: **#8100#: Overall Card Warpage** [IS10373-1]

14.4 Consistency of different Personalization Processes

14.4.1 #4028#: Verification of Consistency

CQM Tag	#4028#		
CQM Requirement	14.4.1 #4028#: Verification of Consistency		
Applicable to Entity	Vendor	Subcontractor	
Applicable to Stage	Design	Qualification	Production
Applicable to CQM Products			

Test Method	The Vendor shall define a suitable Test Method
Default CQM Q-Plan:	
CQM Qualification	Minimum Sample Size: 8
CQM Monitoring	1 item every Set-up, recheck required each 1000 items produced.
Changelog:	
After V2.22	Editorial changes only: wording improved

The Vendor shall verify the consistency between and integrity of different personalization profiles (visual, magnetic, electric, and electromagnetic personalization profiles).

The Vendor shall verify that the different bits of personalized information added onto and into the card are from one personalization data file and data record and that the information is:

- Electrically correct in the ICC
- Electromagnetically correct in the ICC
- Correctly magnetically coded in the Magnetic Stripe
- Correctly visually embossed
- Correctly visually thermal transfer printed
- Correctly re-transfer printed
- Correctly visually indent printed
- Correctly visually drop-on-demand printed
- Correctly visually laser engraved
- Correctly printed using any other method

A change of the configuration or data file shall always be followed by re-verifying the above, as that should be considered a new set-up.



Note

When the vendor processes a personalization lot consisting of cards from different manufacturing batches that may differ for example in artwork (sometimes referred to as a "Rainbow Lot"), and the personalization machine obtains the data for this lot of cards from one data file, then this shall only be considered one set-up. CQM does not require re-verifying this requirement just because the card type changed within such Rainbow Lot.



Note

Depending on the size of the batch, the sampling frequency is not defined at this level. Mastercard strongly recommends checking the first card and the last card of every batch and applying significant sampling methods.

15 Personalization – Test Methods

This chapter defines the Test Methods for the personalization of ID-1 sized products, such as CB, ICC, ICC, IAC.

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15.1 General – test methods applicable to all personalized ID-1 products

15.1.1 #9010#: Durability of Tipping

CQM Tag	#9010#
CQM Test Method	15.1.1 #9010#: Durability of Tipping

15.1.1.1 Description

This test verifies the adhesion between the card's surface and the tipping material applied on top of the embossed characters.

15.1.1.2 Apparatus

Adhesive tape with an adhesive force of 2.5 N/cm, e.g. 3M Scotch Magic Tape 810.

15.1.1.3 Procedure

Place the card on a flat surface. Apply a piece of adhesive tape over the complete embossed area. Firmly rub the tape in a regular way to ensure it is securely stuck to the top of the embossed characters (not on the rest of the card body). Wait for 1 minute. Then pull off the tape very quickly at an angle of about 60 degrees. Check the tape for tipping particles visible with the naked eye.

The test result is Pass, if no tipping particles are visible on the tape.

If tipping particles are visible on the tape, inspect the tipping itself. If no voids are visible in the tipping, and the top of each character is properly covered, the test result is Pass.

Otherwise the test result is Fail.

15.1.1.4 Report

The test report shall state Pass or Fail.

15.1.2 #9020#: Embossed Character Relief Height Retention: Pressure

CQM Tag	#9020#
CQM Test Method	15.1.2 #9020#: Embossed Character Relief Height Retention: Pressure

The purpose of this test is to determine the stability of the embossed character relief height by exposing it to a defined pressure for a defined amount of time.

15.1.2.1 Apparatus

A test stand that applies 245 ± 4 N on a steel anvil with a round flat, having a 6.4 mm diameter.

Personalizers shall use a micrometer with an accuracy of $\pm 10 \mu\text{m}$ or better to control the height of embossed characters.

15.1.2.2 Procedure

1. Measure the relief height of the OCR embossed characters (the PAN) on the test card.
2. Place the embossed card on the test stand in such a manner that two adjacent embossed characters of the PAN are under the anvil. The anvil shall be placed such that the center point of the anvil is approximately above the center point between the two characters.
3. Apply a force of 245 N load onto the embossed characters for a period of one minute.
4. Wait at least 5 minutes after removing the force before measuring the resulting character height.
5. Measure the relief height of the OCR embossed characters (the PAN) on the test card. Ensure the anvil of the micrometer is placed in the area the anvil of the test stand has applied the force to.



Note

The relief height of the embossed characters is the difference in thickness of the card measured including an embossed character and the thickness of the card adjacent to an embossed character and does not include the thickness of the card.

15.1.2.3 Test Report

The report shall state the height of the characters before and after testing.

15.1.3 #9030#: Embossed Character Relief Height Retention: Heat

CQM Tag	#9030#
CQM Test Method	15.1.3 #9030#: Embossed Character Relief Height Retention: Heat

The purpose of this test is to determine the stability of the embossed character's relief height by exposing it to heat.

15.1.3.1 Apparatus

Laboratory Oven capable of maintaining $60^\circ\text{C} \pm 2^\circ\text{C}$.

A micrometer with an accuracy of $\pm 10 \mu\text{m}$ to measure the height of embossed characters.

15.1.3.2 Procedure

1. Measure the relief height of the test card's FARRINGTON 7B embossed characters.
2. Place the embossed cards in the oven, at 60°C for 4 hours.
3. Take the cards out of the oven and cool down for 1 hour.

4. Measure the resulting character height.

15.1.3.3 Test Report

The report shall state the height of the characters before and after exposure to heat, and the change in %.

15.1.4 #9040#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand

CQM Tag	#9040#
CQM Test Method	15.1.4 #9040#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand

15.1.4.1 Description

This test consists of 3 separate methods conducted with different samples to address different types of abrasion.

The samples shall pass the following minimum number of cycles with each method, unless defined otherwise by the requirement:

Method ID	Method Name	Number of cycles
#9041#	Sandpaper Rub Test	5
#9042#	Soft Eraser Rub Test	5
#9043#	Tape Pull Test	1

15.1.4.2 Test Report

The test report shall include for each evaluated printed feature the number of cycles passed for each method and illustrate the status of the feature at the beginning of the test, at the minimum cycle count required and at the end of the test as detailed for each method.

For the results CQM recommends the following categorization:

Category	Definition	Suggested use
C0	No voids visible in the graphical information applied to the card's surface	Strongly recommended result for qualifying a new process of applying graphical information to the card's surface. Recommended result for process control
C1	Voids visible in the graphical information applied to the card's surface, but all text remains legible and all graphics remain identifiably visible	Minimum result for process control; repeated occurrence should trigger improvement actions
C2	Text no longer legible or graphics no longer identifiably visible	Processes and materials showing this category after exposure shall be rejected

15.1.5 #9041#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand – Sandpaper Rub Test

The purpose of this test is to determine the resistance of indent printing, thermal transfer and laser engraving to abrasion caused by rough surfaces.

This is determined by cyclically moving an abrasive surface over the surface to be tested.

15.1.5.1 Apparatus

Square, plane metal surface with an edge length of 35 mm, covered with a grade 320g ("superfine") Aluminum Oxide sandpaper of the same size. The use of 3M Sandblaster "Fine 320" is recommended, as it has shown to be widely available and of consistent quality.

CQM strongly recommends a soft foam layer, 3 mm to 7 mm thick, between the weight and the sandpaper, which helps to reduce the effects of slight unevenness and thus achieve a more consistent result. The recommended range for the shore hardness of the foam layer is from 20 on the shore OO scale up to 60 on the shore A scale. A simple laminate flooring foam underlay has shown to be suitable.

The square metal surface shall apply a force of $15\text{N} \pm 5\text{N}$ to the surface it is applied to.

Flat, rigid base plate.

Means of fixing the sample to the base plate, e.g. double-sided adhesive tape.

15.1.5.2 Samples

Sample Cards shall be taken at least one each from two different print runs.

Should results significantly vary between the two cards, then 3 additional cards shall be tested and the results for all 5 cards reported.

15.1.5.3 Procedure

15.1.5.3.1 Option 1 – Single Direction

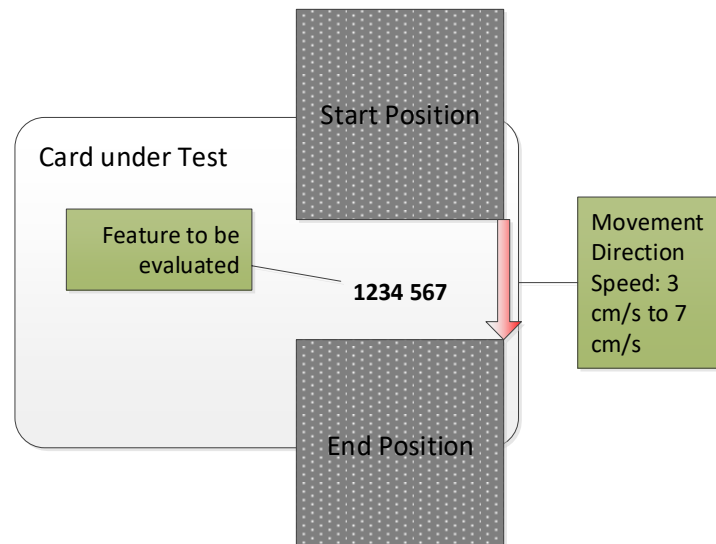
This single direction option is recommended for conducting the test manually, e.g. the weight is moved by hand.

Fix the sample card onto the flat rigid plate, e.g. with double sided adhesive tape.

Document the visual appearance of the Feature to be evaluated using photographs.

Conduct the subsequent sequence for each feature under test:

- Determine the movement axis for the test to be perpendicular to the longitudinal axis of the feature under test.
- In the drawing below the longitudinal axis runs through the digits "1234 567" and the movement axis through the center points of the two squares "Start Position" and "End Position".



- Place the square metal surface with the sandpaper applied onto the card with one edge parallel to the longitudinal axis of the feature under test, but not covering the feature.
- Move the square metal with the sandpaper with a speed of between 3 cm/s and 7 cm/s over the feature under test until the whole abrasive surface has moved across the feature under test. This movement is considered one cycle.
- Now reposition the metal square to its Start Position and repeat the cycle. Avoid the abrasive surface touching the feature under test while doing so.

- Repeat this test for 5 cycles, after which visually inspect, record the result of the visual inspection, and photograph the feature under test.
- CQM recommends to repeat this for a maximum of 30 cycles or until the feature under test is no longer legible (for letters and digits) or identifiably visible²⁴.



Note

If re-using the sandpaper to test multiple samples, use a nylon brush to clean debris off the sandpaper after each sample tested. Replace the sandpaper when it shows any visible sign of degradation. To detect visible degradation of the sandpaper, compare it to an unused sample of the sandpaper. Excessive debris on the sandpaper, or a visibly worn sandpaper do not provide reproducible results.

15.1.5.3.2 Option 2 – Bi-directional

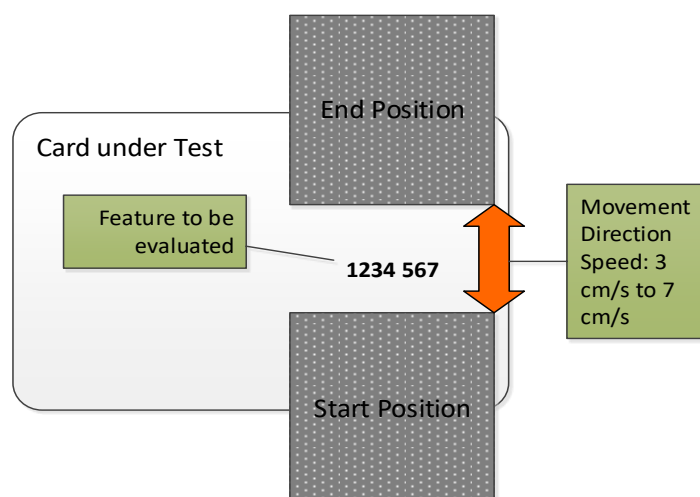
This bi-directional option is permitted for automated test equipment, where the weight is moved by a mechanism.

Fix the sample card onto the flat rigid plate, e.g. with double sided adhesive tape.

Document the visual appearance of the Feature to be evaluated using photographs.

Conduct the subsequent sequence for each feature under test:

- Determine the movement axis for the test to be perpendicular to the longitudinal axis of the feature under test.
- In the drawing below the longitudinal axis runs through the digits “1234 567” and the movement axis through the center points of the two squares “Start Position” and “End Position”.



²⁴ “identifiably visible”: visible to the extent that the original shape can still be recognized, and symbols, logos or other visible additional information contained in or on the un-abraded feature can still be identified.

- Place the square metal surface with the sandpaper applied onto the card with one edge parallel to the longitudinal axis of the feature under test, but not covering the feature.
- Move the square metal with the sandpaper with a speed of between 3 cm/s and 7 cm/s over the feature under test until the whole abrasive surface has moved across the feature under test. This movement is considered one cycle.
- Move the square metal with the sandpaper with a speed of between 3 cm/s and 7 cm/s back to the Start Position over the feature under test until the whole abrasive surface has moved across the feature. This movement is considered one cycle, so moving from the Start to the End Position and back to the Start Position is 2 cycles.
- Repeat this test for 6 cycles, after which visually inspect, record the result of the visual inspection, and photograph the feature under test.
- CQM recommends to repeat this for a maximum of 30 cycles or until the feature under test is no longer legible (for letters and digits) or identifiably visible²⁵.



Note

If re-using the sandpaper to test multiple samples, use a nylon brush to clean debris off the sandpaper after each sample tested. Replace the sandpaper when it shows any visible sign of degradation. To detect visible degradation of the sandpaper, compare it to an unused sample of the sandpaper. Excessive debris on the sandpaper, or a visibly worn sandpaper do not provide reproducible results.

15.1.5.4 Test Report

The test report shall report for each feature:

- The number of cycles conducted; and the number of cycles after which the feature under test:
 - Was first visibly affected
 - Became illegible or was no longer identifiably visible
- If security rules permit, images showing the feature(s) under test at the beginning and the end of the test, plus in between as useful, e.g. to illustrate the time at which the feature became illegible or appeared substantially changed. To avoid conflicts with confidentiality requirements covering personalized information, CQM recommends using dedicated test cards with dummy data, instead of life cards.

²⁵ “identifiably visible”: visible to the extent that the original shape can still be recognized, and symbols, logos or other visible additional information contained in or on the un-abraded feature can still be identified.

15.1.6#9042#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand – Soft Eraser Rub Test

The purpose of this test is to determine the resistance of indent printing, thermal transfer and laser engraving to abrasion caused by soft surfaces.

This is determined by cyclically moving an abrasive surface over the surface to be tested.

15.1.6.1 Apparatus

Soft eraser, type Staedtler Rasoplast 526 B or Staedtler Rasoplast 526 BT Combi, with a nominal surface area of $(12.5 \text{ mm} \pm 1 \text{ mm}) \times (18.5 \text{ mm} \pm 1 \text{ mm})$. If using the Staedtler Rasoplast Combi 526 BT Combi, the soft side of the eraser shall be used.

Flat, rigid base plate.

Means of fixing the sample to the base plate, e.g. double sided adhesive tape.

15.1.6.2 Samples

Sample Cards shall be taken at least one each from two different print runs.

Should results significantly vary between the two cards, then 3 additional cards shall be tested and the results for all 5 cards reported.

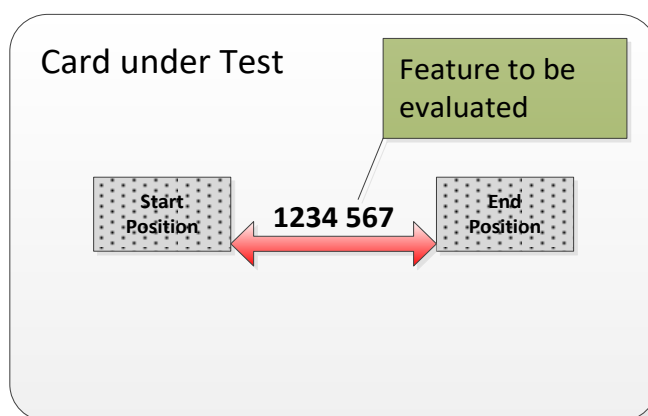
15.1.6.3 Procedure

Fix the sample card onto the flat rigid plate, e.g. with double sides adhesive tape.

Document the visual appearance of the Feature to be evaluated using photographs.

Conduct the subsequent sequence for each feature under test:

- Determine the movement axis for the test to be along the longitudinal axis of the feature under test.
- In the drawing below both the longitudinal axis and the movement axis run through the digits "1234 567".



- Place the eraser flat against the card surface in the “Start Position” with a force of 10N to 15N
- Move the eraser with a speed of between 2 cm/s and 10 cm/s over the feature under test until the whole abrasive surface has moved across the feature under test. Then move it back to the Start Position, maintaining the pressure. This movement from the start positions to the end position and back is considered one cycle.
- Repeat this test for 5 cycles, after which visually inspect, record the result of the visual inspection, and photograph the feature under test.
- Repeat this for a maximum of 50 cycles or until the feature under test is no longer legible (for letters and digits) or identifiably visible²⁶.

15.1.6.4 Test Report

The test report shall report for each feature:

- The number of cycles conducted; and the number of cycles after which the feature under test:
 - Was first visibly affected
 - Became illegible or was no longer identifiably visible
- If security rules permit, images showing the feature(s) under test at the beginning and the end of the test, plus in between as useful, e.g. to illustrate the time at which the feature became illegible or appeared substantially changed. To avoid conflicts with confidentiality requirements covering personalized information, CQM recommends using dedicated test cards with dummy data, instead of life cards.

15.1.7 #9043#: Durability of Surface Printing, Indent Printing, Thermal Transfer, Laser Engraving, and Drop-on-Demand – Tape Pull Test

The purpose of this test is to determine the resistance of indent printing, thermal transfer and laser engraving to abrasion caused by sticky surfaces.

This is determined by applying a tape and pulling it off.

15.1.7.1 Apparatus

Adhesive tape with an adhesive force of 2.5 N/cm, e.g. 3M Scotch Magic Tape 810.

Flat, rigid base plate.

²⁶ “identifiably visible”: visible to the extent that the original shape can still be recognized, and symbols, logos or other visible additional information contained in or on the un-abraded feature can still be identified.

15.1.7.2 Samples

Sample Cards shall be taken at least one each from two different print runs.

Should results significantly vary between the two cards, then 3 additional cards shall be tested and the results for all 5 cards reported.

15.1.7.3 Procedure

Hold the sample card onto the flat rigid plate.

Document the visual appearance of the Feature to be evaluated using photographs.

Apply the tape to the feature under test and rub it on, removing any air bubbles and wrinkles.

Leave the card tape at rest for 1 to 2 minutes, then swiftly peel off the tape perpendicular to the surface of the card.

If multiple cycles are required, apply a fresh tape to the same area and peel it off as described above for each required cycle.

Visually inspect, record the result of the visual inspection, and photograph the feature under test and the tape. Check for missing material in the feature under test and material on the adhesive tape and report and document accordingly.

15.1.7.4 Test Report

The test report shall report for each feature:

- Gaps, voids, and other visible damage in the feature under test resulting from the peel
- Material that stuck to the adhesive tape and thus got removed from the feature under test
- If security rules permit, images showing the feature(s) under test at the beginning and the end of the test. To avoid conflicts with confidentiality requirements covering personalized information, CQM recommends using dedicated test cards with dummy data, instead of life cards.

15.1.8 #9050#: Mechanical Reliability: Absence of Residual Stress

CQM Tag	#9050#
CQM Test Method	15.1.8 #9050#: Mechanical Reliability: Absence of Residual Stress

The purpose of this test is to verify that the embossing process does not initiate beginning of fracture on the surface of the card.

15.1.8.1 Apparatus

Magnifier x10 or more.

15.1.8.2 Procedure

1. Precondition the samples
2. Perform a visual inspection of each embossed or printed character on both sides of the card. Check for the beginning of cracks or the appearance of brittleness.

No defects are allowed.

15.1.8.3 Test Report

Record completion of the inspection, no quantitative report is required.

15.1.9 #9060#: Integrity of Character Reproduction

CQM Tag	#9060#
CQM Test Method	15.1.9 #9060#: Integrity of Character Reproduction

The purpose of this test is to verify the integrity of characters after indent, printing, thermal transfer, laser engraving and Drop-on-Demand printing.


Note: The requirement requests the Vendor to define a suitable method for this check. The Vendor is free to use this or another method, including the inspection of cards personalized as part of regular production.

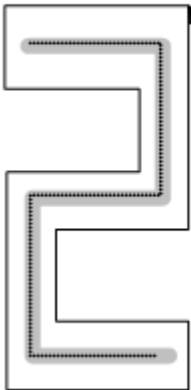


15.1.9.1 Apparatus

Visual inspection or a computerized digital video system with pattern recognition capability.

15.1.9.2 Procedure

1. Personalize the character – set, 1 2 3 4 5 6 7 8 9 0, via the reproduction technologies that are to be certified.
2. Inspect the integrity of the characters as per the following reject list:

Reject type 1:	<p>Misinterpretation of Character</p> <p>1 instead of 7 (7 in Farrington 7B)</p>
Reject type 2:	<p>Incomplete Reproduction of Character</p> <p>For example:</p> <p>2 instead of 2 (OCR 5B)</p> <p>Or  incomplete character "8" in Farrington 7B</p>

Reject type 3:	<p>Non-respect or Inconsistency in the Font used</p>  <p>Template embossing of the character "2" OCR-A</p>
Reject type 4:	<p>Overwriting Characters</p> <p>For example:</p>  <p>"8" written over "3"</p>
Reject type 5:	<p>Printing Outside the Allowed Area</p>  <p>Allowed area</p> <p>Prohibited area</p>

16 #Z000# Change log

16.1 QMS Requirements

Changelog for changes after V2.19.1		
Requirement	Type	Details
#0421#	Editorial	
#0422#	Editorial	
#0431#	Editorial	
#0441#	Editorial	
#0442#	Editorial	
#0461#	Editorial	
#0481#	Editorial	
#0482#	Editorial	
#0580#	Editorial	
#0652#	Editorial	
#0653#	Editorial	
#0551#	Editorial	
#0552#	Editorial	
#0561#	Editorial	
#0553#	Editorial	
#0571#	Editorial	
#0651#	Editorial	
#0582#	Editorial	
#0654#	Editorial	
#0706#	Editorial	
#0581#	Editorial	
#0501#	Editorial	
#0601#	Editorial	
#0604#	Editorial	
#0605#	Editorial	
#0603#	Editorial	
#0704#	Editorial	
#0721#	Editorial	
#0722#	Editorial	
#0723#	Editorial	
#0741#	Editorial	
#0761#	Editorial	
#0762#	Editorial	
#07073#	Editorial	
#0703#	Editorial	
#0861#	Editorial	
#0862#	New	
#0863#	New	
Changelog for changes after V2.22		
Requirement	Type	Details

Changelog for changes after V2.22.1		
Requirement	Type	Details
#0422#	Editorial	
#0431#	Editorial	merged with R-QM-29, title changed
#0441#	Editorial	title changed
#0724#	New	
#0482#	Technical	Incorporates R-QM-06, additional changes to text for clarification
#0561#	Editorial	
#0501#	Editorial	changes to make more precise and clarify; required to be assessed during audit
#0701#	Technical	reworded, detail requirement for QCP; requirement must be addressed during audit
#0722#	Technical	result from split of R-QM-58, wording changed
#0723#	Technical	result from split of R-QM-58, wording changed
#0742#	Editorial	title changed
#0781#	Technical	now considered covered by an ISO 9000 certificate
#0705#	Technical	must be addressed during audit
#0811#	Technical	must be addressed during audit
#0821#	Editorial	
#0841#	Technical	includes now requirement to complete the CQM Assessment Plans as the result of internal audit and internal product assessment
#0861#	Editorial	note inserted to clarify that this is not a requirement for a management review in addition to the ISO 9001 one, incorporates R-QM-19
#0862#	Editorial	title changed, content reduced to CQM relevant items
#0863#	Editorial	title changed, content reduced to CQM relevant items
#0882#	Technical	Follow-up for corrective actions clarified, to be assessed during audit
#0881#	Technical	now considered covered by an ISO 9000 certificate

16.2 Product Requirements

Changelog for changes after V2.19.1		
Requirement	Type	Details
#2006#	Editorial	clarified that any IC inside the CHD must comply with this requirement.
#2024#	Technical	Reference to 14443-1 and -2 removed, as sufficiently addressed by EMVL
#3065#	Editorial	adjusted to recent edition of 7810
#3025#	Technical	Now only requires compliance with 7811-6
#3015#	Technical	Added concept of Critical Test Strips to reduce effort during monitoring
#3016#	Technical	Added concept of Critical Test Strips to reduce effort during monitoring

#3021#	Editorial	References 7810, minor editorial
#3030#	Technical	removed
#3031#	Editorial	changelog corrected
#3034#	Editorial	clarified that MC no longer requires UV print, wording adjusted to cover the case that issuer requires UV print.
#3041#	Editorial	content replaced by reference to 7810
#3042#	Technical	IAC related items added from CSI Testplan for fingerprint cards
#3043#	New	Imported from CSI.
#3069#	New	Imported from CSI.
#3044#	Technical	modified to accommodate CSI requirements for biometric cards
#3045#	Technical	modified to accommodate CSI requirements for biometric cards, clarified that advanced functionality must survive exposure
#3046#	Technical	referring now to 7810.
#3047#	Technical	Made applicable for IAC
#3067#	New	
#3100#	Technical	Added reference to CEC Certification.
#3068#	Technical	new, imported from CSI, R-CSI-Bio2.
#3057#	Technical	Test frequency reduced from 1/day to 1/month to synchronise with standard 3 wheel test. Examples for MSA added. Reminder inserted that non-conforming products must receive CSI letter.
#2039#	Technical	New. Imported from CSI, R-CSI-Bio5.
#2040#	Technical	New. Imported from CSI, R-CSI-Bio6.
#2041#	New	Imported from CSI, R-CSI-Bio7.
#2042#	New	Imported from CSI, R-CSI-Bio8.
#2043#	New	Imported from CSI R-CSI-Bio4. Added that such functional verification shall not require the use of a real or simulated biometric credentials.
#2044#	New	
#2811#	Editorial	reference to AMD2 removed, as this is now incorporated into the 2018 version of 14443-1
#4004#	Technical	note added permitting sample PANs with one example, editorial changes
Changelog for changes after V2.22		
Requirement	Type	Details
#3067#	Technical	Major rewrite to accommodate greater tolerance for placing notches defined in CDS
#3100#	Technical	clarification that embedding CQM qualified iacIL, iacICM, BSM in card do not count.
#3120#	New	
#3130#	New	
#3050#	Technical	Permitted maximum aligned with threshold for obtaining CSI letter, permitted maximum increased to 25% for scenarios 5 and 6.

#3057#	Technical	added clarification regarding re-using sample and validity of results obtained using a force higher than the minimum force.
#2039#	Editorial	reworded to improve understanding
#2041#	Technical	Number of abrasion cycles defined as 120
#2805#	Technical	adjustments for IAC and revised wording
#4028#	Editorial	wording improved
Changelog for changes after V2.22.1		
Requirement	Type	Details
#2005#	Technical	made specifically applicable to wafer backside processing
#3069#	Editorial	tag changed from #3043# to #3069# as was duplicate
#3050#	Technical	Clarification added how to handle false positives due to certain magnetic stripes.

16.3 Test Methods

Changelog for changes after V2.19.1		
Requirement	Type	Details
#6006#	Technical	Clarified that both sides shall be tested.
#7010#	Editorial	Test report refers now to DeltaE and no longer to Delta LCH
#7020#	Technical	removed
#7030#	Technical	various changes to improve usability
#8240#	Technical	Adjusted to modifications in 10373-1, clarified that each strip must be tested in both directions. Added provisions to address periodic oscillations or rippling through retesting at lower peel speed.
#8140#	Editorial	minor editorial, note inserted alerting to changes in 2020 edition of 10373-1
#8150#	Editorial	
#8160#	Editorial	
#8200#	Editorial	
#8221#	Technical	New, imported from CSI, TM-CSI-Bio2.
#8250#	Technical	Added contact scenarios 5 and 6 for cards to accommodate discharge path via fingerprint sensor and 7816-2 contacts, corrected table of contact scenarios for materials, clarified that each contact should be connected via 10 MOhm resistor to ground to avoid build up of residual charges on contacts that are floating during a contact scenario.
#8270#	Technical	Incorporating CSI TM-CSI-Bio1
#8290#	New	Adopted from CSI method TM-CSI-Bio5
#8291#	New	Adopted from CSI method TM-CSI-Bio5
#8300#	New	Adopted from CSI method TM-CSI-Bio7
#8310#	New	Adopted from CSI method TM-CSI-Bio8
Changelog for changes after V2.22		

Requirement	Type	Details
#7120#	Technical	clarified that if cross-hatch necessary, a new sample shall be used.
#7121#	Technical	clarified that if cross-hatch necessary, a new sample shall be used.
#8230#	Technical	Clarified positioning of centre of pressure for multicentric ICM, for example combining ISO/IEC 7816-2 contacts and a fingerprint sensor into a single ICM.
#8250#	Editorial	change of wording of permitted interval for calibration check to avoid misunderstanding.
#8310#	Technical	More detail added about how to conduct test.
Changelog for changes after V2.22.1		
Requirement	Type	Details
#7120#	Editorial	#7120# split into two separate requirements, one for visual, one for adhesion
#7121#	Editorial	#7120# split into two separate requirements, one for visual, one for adhesion

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