



BSI Standards Publication

**Security and resilience — Authenticity, integrity
and trust for products and documents —
Guidelines for the content, security, issuance
and examination of excise tax stamps**

National foreword

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**Security and resilience — Authenticity,
integrity and trust for products
and documents — Guidelines for
the content, security, issuance and
examination of excise tax stamps**

*Sécurité et résilience — Authenticité, intégrité et confiance pour
les produits et les documents — Lignes directrices relatives au
contenu, à la sécurité, à l'émission et à l'examen des timbres fiscaux
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 292, *Security and resilience*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to assist tax authorities to enhance compliance with excise tax regulations by implementing new, or improving existing, excise tax stamps and associated issuance systems. This document provides guidance for tax stamp procurement, construction, security, issuance and examination.

As an indirect tax, excise duties are an effective way for national, state or provincial governments to raise revenue. As they are most commonly applied to tobacco and alcoholic consumer products they also serve the purpose of discouraging consumption of these health-endangering products. Several countries, however, are extending the use of excise taxes and therefore tax stamps to other fast-moving consumer goods (FMCG), such as soft drinks, entertainment software and more. As the range of taxed goods expands, it becomes more important that tax stamps match best practice in the field.

Because consumers often seek to buy cheaper, un-taxed or under-taxed goods, the supply of such goods attracts criminal activity with the goal of tax avoidance, often leading to products that may be dangerous to consumer health.

Security and resilience — Authenticity, integrity and trust for products and documents — Guidelines for the content, security, issuance and examination of excise tax stamps

1 Scope

This document gives guidelines for the content, security, issuance and examination of physical tax stamps and marks used to indicate that the required excise duty or other applicable taxes identified with an item have been paid and to signify that the item is legitimately on the intended market.

Specifically, this document gives guidance on:

- defining the functions of a tax stamp;
- identifying and consulting with stakeholders;
- planning the procurement process and selection of suppliers;
- the design and construction of tax stamps;
- the overt and covert security features that provide protection of the tax stamp;
- the finishing and application processes for the tax stamp;
- security of the tax stamp supply chain;
- serialization and unique identifier (UID) codes for tax stamps;
- examination of tax stamps;
- monitoring and assessing tax stamp performance.

This document is applicable only to tax stamps that are physical in nature and apparent to the human senses of sight (with the aid of a revealing tool if necessary) or touch, applied to a consumer good or its packaging and which allow material authentication. When the term “authentication” is used in this document, it refers only to the authentication of the tax stamp, not to the product on which the tax stamp is affixed.

This document does not apply to systems or procedures that an issuing authority has in place to control and monitor its excise revenue collection, except by reference to them where they have an impact on the design or specification of tax stamps.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 22300, *Security and resilience — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22300 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

**3.1
activation**
stage in production or use of a *tax stamp* (3.11) when *applicable taxes* (3.4) become due
Note 1 to entry: Activation of the *unique identifier* (3.14), if used, can be separate from activation of the tax stamp.

**3.2
adhesive**
chemical mixture that bonds two materials together
Note 1 to entry: “Adhesive” can also be referred to as “glue”.
Note 2 to entry: It can be enabled by heat, pressure or chemistry.

**3.3
alteration**
intentional attempt to change an authentic item or the data contained within or on an item by chemical, abrasive or other techniques
Note 1 to entry: In this document, an “item” is a *tax stamp* (3.11).

**3.4
applicable tax**
excise and other revenue tax on products as defined within national, state, provincial or local law

**3.5
authentication**
process of corroborating an entity or attributes with a specified or understood level of assurance
Note 1 to entry: In this document, an “entity” is a *tax stamp* (3.11).

Note 2 to entry: The phrase “specified or understood level of assurance” acknowledges that it is impossible to achieve absolute certainty in authenticating any item. The degree of certainty varies with the type of authentication solutions used, the training and motivation of the examiner and the equipment available to them. For example, the level of authentication assurance achieved is very different between a consumer and a forensic laboratory.

**3.6
direct marking**
applying a *tax stamp* (3.11) directly onto the product container through the use of laser marking or printing with inks or other markers that adhere to the material of the container

**3.7
illicit product**
taxable consumer product made available to the market to avoid the payment of all or part of the due *applicable taxes* (3.4)

Note 1 to entry: As part of the risk assessment, *tax authorities* (3.10) should refer to legislation and regulations in their jurisdictions to ascertain what qualifies as an illicit product.

Note 2 to entry: Illicit products could include illegally manufactured, adulterated, re-filled, smuggled or illegal re-imported products.

**3.8
substrate**
material that a *tax stamp* (3.11) is made of when it is produced away from the site of the *tax stamp applier* (3.12)

3.9

tamper evident

ability to reveal that an item has been compromised

Note 1 to entry: In this document, an “item” refers to a *tax stamp* (3.11).

3.10

tax authority

government (national, provincial, state or local) agency that has responsibility for the collection of *applicable taxes* (3.4) and for the specification and design of *tax stamps* (3.11)

Note 1 to entry: The tax authority might be an independent agency or part of customs, the ministry of finance or other revenue authority.

3.11

tax stamp

visible stamp, label or mark placed on certain types of consumer goods to show that the applicable excise tax has been paid

Note 1 to entry: It can be in the form of a label, closure seal, indicia or mark applied to the product, the package or container of the taxable item.

Note 2 to entry: Tax stamps are a tool within a government’s system for the collection and protection of *applicable taxes* (3.4).

Note 3 to entry: *Substrate* (3.8)-based tax stamps are also referred to as “tax seals” and “tax banderols” (sometimes spelled “banderoles”).

3.12

tax stamp applier

entity that applies a *tax stamp* (3.11) to a taxable product

Note 1 to entry: The application can be done by *direct marking* (3.6) or by applying a *substrate* (3.8)-based tax stamp.

Note 2 to entry: A tax stamp applier is usually a manufacturer, packager or importer of a taxable product or products, or a tax stamp supplier that is also responsible for reporting the application of the tax stamp to the *tax authority* (3.10), with information about the product it is affixed to if and when required by the tax authority.

3.13

tax stamp stakeholder

entity with a stake in the implementation, enforcement and use of a *tax stamp* (3.11) system

3.14

unique identifier

UID

code that represents a single and specific set of attributes that are related to an object or class of objects during its life within a particular domain and scope of an object identification system

Note 1 to entry: ISO 22300 defines “object” and “identification”.

4 Process overview

The tax authority should regularly review its tax stamp programmes, including security, legislation and enforcement, to identify any weaknesses in the tax stamp itself or in the procedures for production, issuance, activation, application and examination. The tax authority should have a standby tax stamp design that can quickly be put into production in the event that this review or enforcement activity reveals fraudulent production or use of the tax stamps in use.

NOTE Issuing a new tax stamp design is the quickest way to make fraudulent tax stamps obsolete.

[Figure 1](#) summarizes the process recommended in this document.

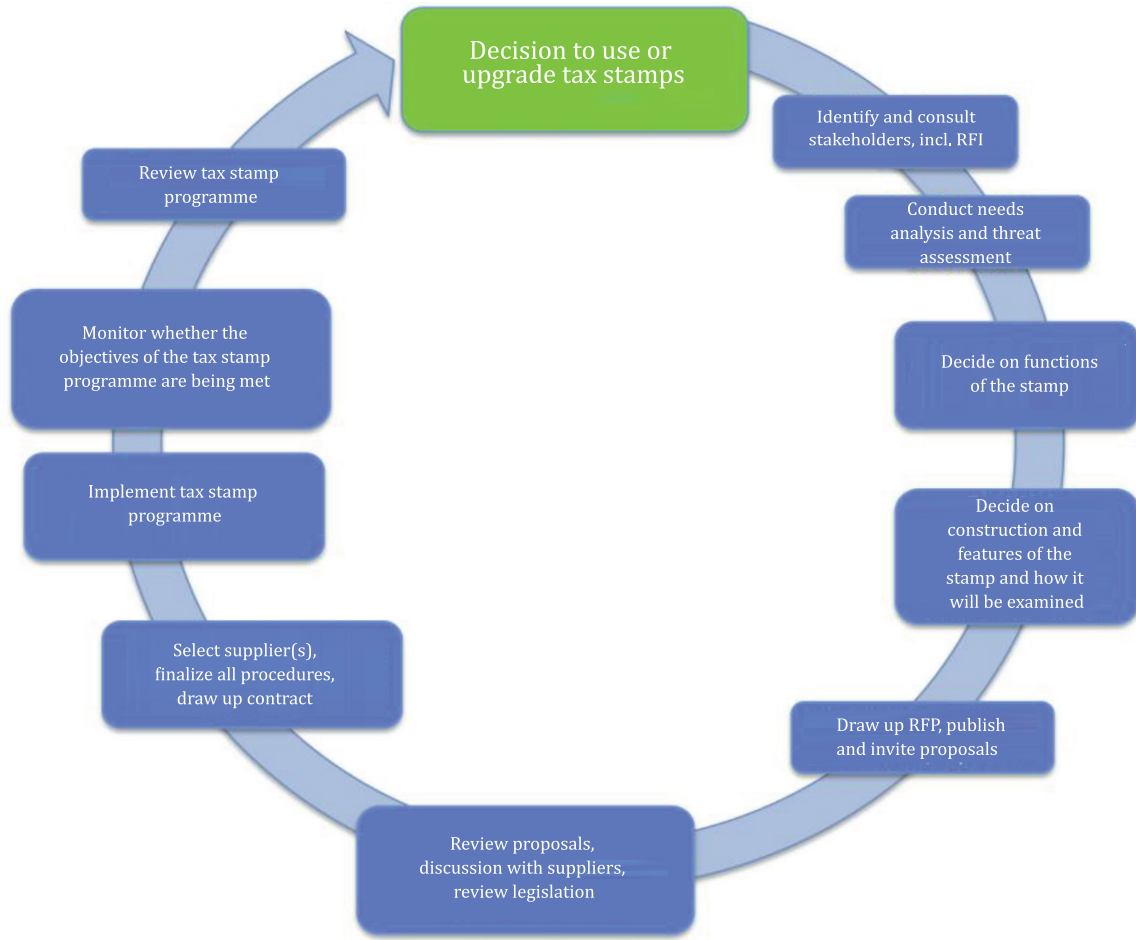


Figure 1 — Tax stamp procurement and review process

5 Identify and consult stakeholders

The tax authority should identify and consult with all relevant tax stamp stakeholders in identifying functions and drawing up specifications for a tax stamp. Relevant tax stamp stakeholders will vary across jurisdictions and may include the following.

- **Manufacturers** of taxable goods that produce and package finished goods subject to taxation. Depending on local circumstances and tax systems, manufacturers could order, receive and apply tax stamps to finished goods. A manufacturer can also act as the local distributor.
- The **trademark holder** that owns the trademark in the taxable goods. This is often the same entity as the manufacturer but not always.
- **Importers of taxable goods** that import part- or wholly-finished goods subject to taxation and that are responsible for the payment of applicable taxes and fees. The importer may order, receive and apply tax stamps to finished goods.
- **Distributors or wholesalers of taxable goods** that bring the taxable products from a warehouse or port to the local market and that could be responsible for paying taxes to the domestic tax authority and applying the tax stamp on these products.
- **Retailers of taxable goods** responsible for procuring the taxable goods through the legal supply chain to sell to a consumer and that are required to verify the presence of the tax stamp.

- **Tax stamp providers**, which can be one or more organizations that provide tax stamps and examination tools to the tax authority, law enforcement agencies and other authorities as determined by the tax stamp authority to enable efficient tax collection and protect against fraud.

NOTE A tax stamp provider can also supply or specify application and other equipment for handling the tax stamps. It could provide only the physical tax stamp or whole systems, which can include IT systems, serialization, activation, direct marking and coding systems.

- **Law enforcement agencies** that provide regulatory and criminal enforcement of the applicable laws. These agencies may include customs, revenue police, national police, defence forces, coastguards, border-control, security services, prosecution services, financial auditing authority, health officials and others.
- **Consumers** who are the end-user of a taxable product, consulted by the tax authorities through representative consumer groups and not as individuals when seeking input from the public.

6 Functions of a tax stamp

6.1 Overview

When determining the specification for the physical nature of tax stamps it will issue, the tax authority should first consider the functions that it requires the tax stamp to fulfil, e.g. whether the tax stamps will serve any functions in addition to the tax collection function, and the implications of these functions for their construction and design. Whatever function or functions the tax stamp is to fulfil, the tax authority should ensure that the tax stamp can be authenticated as genuine and that counterfeit, altered, tampered with or otherwise fraudulent tax stamps can be detected.

The tax authority should consider the possibilities described in [6.2](#) to [6.4](#).

6.2 Core function — Revenue collection

As a statement of tax liability or receipt, a tax stamp may fulfil many functions. The revenue tax authority should identify all the functions it requires of the tax stamp. Possibilities include:

- creating the tax liability at the tax stamp's point of issue or application to the taxable product;
- being a receipt for the payment of applicable taxes;
- validating the tax-paid status of goods in the supply chain;
- identifying non- or reduced-tax-paid goods in the supply chain;
- enabling the revenue authority to monitor or (where necessary) control the production or importation of taxable goods through the number of tax stamps issued to the organization that applies them.

6.3 Tracking, tracing and monitoring

It is recommended that the tax authority develop a track and trace system for tax stamps that allows it to find when, where and by which entity the tax stamp was applied on the product. The tax authority should use information about the product's origin and the route by which it reached the point where it is being examined to identify suspicious or criminal activity in the supply chain.

The tax authority should consider the consequential requirements to implement and make effective supply chain monitoring and tax stamp tracking if these functions are to be undertaken. These requirements may include:

- the UID to be applied to the tax stamp (see [Clause 11](#)) or an alternative method of identifying and tracking each item;

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- monitoring stations or monitoring staff at points in the supply chain to record information about the location of the product and the tax stamp on it;
- the secure storage and handling of the data that is captured from this monitoring;
- the analysis of data and sharing it with law enforcement agencies, manufacturers or distributors and other relevant stakeholders.

NOTE Tracking is monitoring an item through a supply chain, while tracing is the ability to check where an item has been (see ISO 12931). This is also sometimes referred to as “traceability”.

Figure 2 provides an example of how track and trace can be useful for monitoring tax stamps in the supply chain.

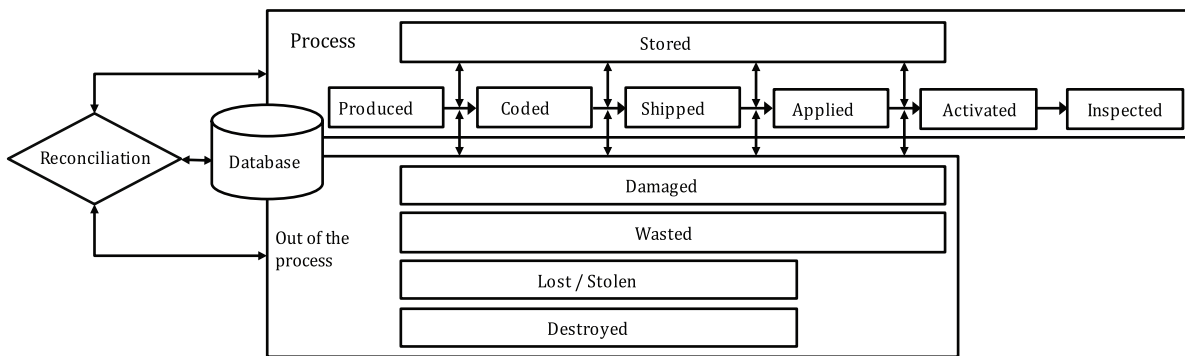


Figure 2 — An example of a process of track and trace and reconciliation for tax stamps

Tax authorities should consider opportunities for interaction with other fiscal domains (outlined in ISO 22381) and other stakeholders, as appropriate.

6.4 Possible additional functions

The tax authority should consider the other functions a tax stamp can serve that are not directly related to the tax collection and tax enforcement function in consultation with other stakeholders, particularly other government agencies.

Other functions might include:

- **consumer reassurance** by means of a tamper-evident substrate-based tax stamp (see 8.4), which cannot be removed from the taxable product without being destroyed, making it more probable that an item bearing a tax stamp is legitimate;
- tax stamps can facilitate **legislative compliance** where local, national or supra-national legislation or other regulations require tracking and tracing for certain products.

It is, however, acknowledged that there is also a chance that an item affixed with a tax stamp could be illicit. As a result, authorities should be cautious in adopting or communicating the consumer confidence function of tax stamps when the tax stamp serves other functions that are not directly related to the tax collection and tax enforcement function. This serves to avoid any potential liabilities should a citizen be harmed by a product bearing a tax stamp.

7 Procurement process

7.1 Preliminaries

The tax authority or agency purchasing tax stamps should ensure that the procurement process is open, transparent and meets the sustainability objectives in ISO 20400. Where more than one organization is involved in the supply of tax stamps or for the whole tax stamp programme, or if the suppliers operate

as a consortium, both sides should be clear about who is involved. The tax authority should use a request for information (RFI) as the first step in its procurement process.

NOTE 1 An RFI:

- serves as an early alert to potential suppliers;
- provides the tax authority with an information-gathering exercise to identify the suppliers which can actually meet its requirements and filter out those that claim they can meet the requirements but are unlikely to do so;
- helps the tax authority to refine its requirements or specification by providing information on the capabilities of possible suppliers;
- allows potential suppliers to show whether they will work alone or as part of a consortium, and what others would be involved in the consortium;
- helps the authority in budgeting for its tax stamps.

The tax authority or its purchasing agency should clearly specify the tax stamp requirement and run an open tender process. The specification should result from a needs assessment and a risk and threat assessment, as described below.

- A **needs assessment** should cover existing and needed legislation, regulations and decrees to implement and protect a comprehensive tax stamp system. It should also cover stakeholder interoperability, inspection and interdiction procedures, criminal investigations and prosecutions;
- A **risk and threat assessment** includes a comprehensive analysis of past, present and potential future tax evasion, organized crime and public corruption threats, including any risk to tax stamps or tax stamp systems.

The tax authority should work with stakeholder organizations to overcome any weaknesses identified through these assessments, including the selection of appropriate security features to mitigate against identified threats.

NOTE 2 More information on conducting a risk assessment can be found in IEC 31010 and ISO 22380.

7.2 Request for proposal

A tax stamp request for proposal (RFP) is a request or invitation to tender that clearly explains the tax authority's goals.

The tax authority should consider whether to:

- give a set of specifications for the tax stamp programme and the systems it requires to meet those goals; or
- invite tendering organizations to propose alternative solutions which they believe will best meet the tax authority's overarching goals; or
- establish a set of qualities, characteristics, and experience desired in a relationship with a supplier organization, with these qualities becoming the basis for the procurement.

When the tax authority sets out the goals and requirements, it should give tendering organizations leeway in proposing optimum solutions that might be different to those the authority would specify. The RFP should state the responsibilities in implementation, performance, decommissioning or replacing an offered solution.

The tax authority should include references in the RFP to key public sector stakeholders so that suppliers are aware of the total environment for the use of the tax stamp.

The tax authority should consider a closing date for submission of proposals that allows time for translation of the tender and of proposals, and for production of samples, shipping and proof of concept mock-ups.

NOTE Guidance on the content of an RFP is provided in [Annex A](#).

7.3 Selection of suppliers

Before finalizing and issuing the RFP, the tax authority should:

- consider the type of organization that it wants as its tax stamp supplier based on its experience, reputation, customer list and other factors;
- consult with appropriate stakeholders or other government organizations that use secured documents for input into considering these criteria and into influencing the way that the RFP is published, publicized and evaluated;
- ensure that suppliers of tax stamps, component suppliers and support systems or services suppliers and any other sub-contractors meet the security requirements identified in the security risk assessment;
- consider international and national standards covering the secure production, transportation and destruction of security materials, such as substrates, foils and finished printed documents and their associated data and data management systems, as it assesses the security of potential suppliers;
- seek confirmation that any tendering organization is certified as conforming to these standards.

NOTE Relevant standards are listed in the Bibliography.

7.4 Rights

The tax authority should also consider the ownership of rights in the design and artwork materials when drawing up the RFP and drafting the supply contract, recognizing that, in most countries (including the 173 countries that follow the Berne Conventions on copyright), the creator of an item, usually the producing company or a sub-contractor, owns the copyright on that item as soon as it is created.

The tax authority should consider the following options:

- the tax authority (as the customer) is assigned the copyright in the artwork and the final tax stamp design;
- the creator (the supplying printer or sub-contractor) retains the copyright, but undertakes to produce items using that design only on instruction from the customer (the tax authority).

The tax authority should:

- specify, in the contract, the ownership of the rights, the production rights and limitations on the rights owner or producer;
- ensure that the supplier has the right to use any copyrights, design rights, patents or other rights that apply to components from third party suppliers;
- stipulate in the contract the rights of and limitations on the supplier to use any designs, logos or other images such as the logo or shield of the tax authority supplied to it by the tax authority.

8 Tax stamp construction

8.1 Overview

The tax authority should determine the physical construction of its tax stamps and choose the most appropriate components, considering the required levels of security identified in the risk assessment to protect tax stamps against counterfeiting, alteration, theft or removal, as well as the output from the needs assessment.

The tax authority should consider the following tax stamp components:

- substrate;
- inks;
- adhesives;
- authentication or security features to make it more difficult to replicate, copy or amend;
- laminate;
- UID (see [Clause 11](#)).

The tax authority should consider the use of a combination of authentication features when deciding on a tax stamp design to ensure an appropriate level of security. Several disciplines contribute to this combination, including:

- security design to incorporate graphic features that are difficult to copy or replicate;
- chemistry in the choice of inks, lacquers and adhesives;
- material science in the substrate and adhesive;
- optics in the optically variable devices;
- encoding for the UIDs.

NOTE 1 The production process incorporates these authentication features in the implementation of technologies covering printing and inks, foil transfer or embossing. [7.2](#) allows for the components to be specified by the tax authority in the RFP, or for vendors to propose materials, components and techniques that, in their view, best meet performance requirements.

The tax authority should:

- select components for their durability, resistance to fraud, aesthetic qualities and compatibility with any existing equipment or systems, in discussion with the supplier;
- consider by whom and how the tax stamp will be examined for authenticity, including factors such as the cost, portability, training and tools needed to examine the authentication features selected;
- include those that most effectively protect against threats identified in the risk analysis when selecting the authentication features for its tax stamps;
- analyse the performance of features relative to their cost.

NOTE 2 The main design and authentication decisions and the interdependence between them are shown in [Annex B](#).

8.2 Design, size and position

The tax authority should specify the size and positioning of tax stamps after consultation with manufacturers or importers of taxable products, recognizing that different packaging may require

different tax stamp types, impacting the design and authentication features that can be included on each tax stamp.

The tax authority should consider the following factors:

- the space available on the taxable product pack, allowing for brand markings and any legally-required health warnings that may be on the pack, such as those required on tobacco and alcohol products;
- whether the tax stamp is to serve as a closure seal (see [8.5](#));
- the size of the tax stamp that ensures the text is human- and machine-readable, and that UIDs/data carriers can be read efficiently;
- the appropriate position of the machine-readable UID on the tax stamp so it can be scanned efficiently;
- the size of the authentication features for them to be effective for human or tool inspection (see [12.2](#)) and all conditions under which the tax stamps will be examined;
- the minimum size that can be handled by the equipment used for applying the tax stamps to the taxable products, which may be different for self-adhesive and wet-glue labels.

8.3 Authentication features

The tax authority should specify the two main types of authentication features, overt and covert, that are described in ISO 12931.

NOTE 1 An overt authentication element is detectable and verifiable by one or more of the human senses without using a tool other than those commonly used to correct imperfect human senses (e.g. spectacles or hearing aids).

NOTE 2 A covert authentication element is hidden from human senses and requires the use of a tool by an informed person to reveal it or to allow automated interpretation of the element.

The tax authority should take in to account the following three interdependent components in an effective authentication system:

- the authentication feature or features integrated in or affixed to the tax stamp;
- the examiner;
- the tools or equipment needed to examine the authentication features.

The tax authority should consider the stakeholder requirements (see [Clause 5](#)) for examination, training and equipment when deciding which authentication features to use.

NOTE 3 Refer also to [Clause 12](#) on examination.

The tax authority should:

- achieve the best protection for a tax stamp by using a combination of specific and layered security features (overt and covert) depending on the configuration and the control to be performed (e.g. by consumers or authorities) during the life cycle of the product;
- note that a printed UID not associated with one or more authentication features or not protected against copying or replication cannot provide authentication.

NOTE 4 Authentication features, such as holograms, security substrates, security inks, taggants, copy-protected codes and other features are described in [Annex E](#). Security printing processes are described in [Annex F](#).

8.4 Tamper evidence

The tax authority should:

- affix tax stamps to the taxable product in a way that ensures they cannot be altered, replaced or reused;
- choose appropriate tamper-evident properties, where tax stamps have an additional role as closure seals that do not allow opening, retrieval of product or refilling of the container without noticeably damaging the tax stamp;
- consider the results of the risk assessment undertaken as recommended in [Clause 7](#).

The tax authority should recognize that tamper evidence is a complex function of the combination of:

- the material and surface properties of the product or packaging to which the tax stamp is applied and the adhesion of the tax stamp or of the direct print to this;
- the cohesion of the printing ink or inks;
- the cohesion of the tax stamp substrate or of any lamination if this is its construction.

The tax authority should evaluate tamper evidence in terms of:

- the obviousness of change in the tax stamp's structure on alteration, tampering, tearing or opening, both when intended or unintended;
- the possibility of tax stamps being reused or harvested from used packaging;
- the amount of technology input, capital investment, criminal effort and the expected return on this fraud.

8.5 Substrates

The tax authority should specify or consider the substrate, paying attention to:

- what the tax stamp is going to be affixed to and if it will be applied to different packaging or product materials each requiring different substrate and adhesive combinations;
- whether the tax stamp is required to be tamper-evident;
- whether it will function as a closure seal;
- what level of security is required in the substrate, bearing in mind that this needs to be considered in relation to adhesives and other components;
- whether any of the graphical and security components of the tax stamp will be within the substrate, which requires it to be a secured material, made in secure premises and transported by secure methods;
- whether the substrate is a security feature itself, such as a hologram embossed onto a polymer, that is the carrier for the printed design and any other features the tax authority specifies.

NOTE More guidance on security substrates is given in [Annex C](#).

8.6 Printing, inks and coatings

8.6.1 Printing method

The tax authority should consider that different processes give different effects and differing levels of security. It should work closely with the supplier on the selection of printing processes and the choice of inks and coatings used in the printing of tax stamps that will affect the level of security.

The tax authority should specify the security level of equipment and technologies based on its risk assessment of potential threats from tax evasion, counterfeiting of the tax stamp and other relevant data. It should choose specialized printing equipment and technologies that are designed for the production of security documents by adding barriers against counterfeiting, including technological, capital and accessibility barriers.

Tax authorities should consider the following best-practice techniques that raise the barrier to counterfeiting and other forms of fraud and ensure that at least some of these techniques are incorporated in their tax stamp design:

- the use of graphical security designs on the tax stamp;
- complexity in the design and processes required to print the tax stamp;
- a combination of printing tools and methods, especially in the small space usually available on a tax stamp;
- the registration of different parts of a design, including graphic and security features, within tight tolerances;
- the use of specialist techniques and expertise that are difficult for criminals to source.

The tax authority or its purchasing agency should either specify the methods and materials to be used or state the required level of security and request tendering organizations to state how they will achieve this.

NOTE More information on appropriate printing techniques is given in [Annex F](#).

8.6.2 Print and ink security features

The tax authority should:

- consult with stakeholders and the selected or potential supplier when specifying the inks and coatings to be used on tax stamps and the design and printing techniques to be used;
- ensure that these meet the security requirements established in the RFP;
- incorporate several overt and covert security features into the printed graphics of the tax stamp, either through the use of special inks, printing techniques and coatings that are reserved by manufacturers for security documents, or through the combination of ink and printing techniques;
- consider who will be examining the tax stamps when specifying the design, printing methods and inks to be used, as some printed security features can be detected by human senses, while others require the use of special tools, such as those used by law enforcement inspectors, that are not readily available to the public.

NOTE Guidance on the examination processes is given in [Clause 12](#).

8.7 Adhesives

The tax authority should consider adhesives as a critical component of tax stamps, as they are affixed to the taxable product or its packaging. Adhesives should meet the requirements for durability and tamper evidence.

NOTE Adhesives can be on the underside of the tax stamp substrate in the form of permanent adhesives or dry gums or added during application of a tax stamp to the taxable product. If the tax stamp is in the form of a shrink sleeve, there may be no need for adhesive.

The tax authority should make an informed decision on the types and the combination of adhesives, considering:

- the surface properties of the product or the packaging onto which tax stamps are to be applied, such as porosity, moisture content or receptiveness to different types of adhesive, as tax stamps for different types of pack or container may require different adhesives;
- the devices applying the tax stamp, with regard to cost, speed and availability;
- the requirements for tamper-evident fixing of the tax stamp, noting that the strength of adhesion and reliability of tamper evidence are not just defined by the choice of the adhesive, but by the overall construction of the tax stamp (see [8.4](#)).

8.8 Direct marking

The tax authority should consider and discuss with the producers or importers of taxable product the option of printing the relevant taxation information directly on to the taxable product itself or on its primary packaging or label as an alternative approach to using a separate material tax stamp. This is known as direct marking.

Direct marking:

- enables high-speed printing of the tax serial number on to a part of the primary or secondary pack or container;
- does not require the application of a separate tax stamp.

As direct marking does not offer the variety of authentication features that can be built in to a separate tax stamp, the tax authority should require the use of security methods, including inks and other consumables, that incorporate overt and covert components. The tax authority should also ensure that all driver software and digital data files are secure and the marks include a UID that incorporates or links to data about the product the mark is on. Methods of protecting and controlling the content of the printed UIDs against duplication of the UID or the reuse of data should be considered.

The tax authority should consider the following factors when choosing between material tax stamps and direct marking:

- the type of container, its shape, rigidity and material characteristics in terms of ink or tax stamp adhesion;
- the speed of the production or packaging line where the tax information is to be applied and the number of items to be marked or tax stamped per minute;
- the environmental conditions, such as humidity, temperature and dust, on the production or packaging line that could affect the effectiveness of the adhesive used to affix the tax stamp;
- the space on the container for the tax information so that it does not cover legally required information or brand markings;
- the ability to protect and control the printed UIDs;
- the value of the tax, related to the cost of re-using or refilling the container;
- how to avoid direct-marked components being illegally re-used, such as when the tax stamp is direct-marked onto a drink bottle cap making it feasible to re-fill bottles and re-seal with a crown from an emptied bottle.

NOTE A table comparing the characteristics of direct marking and material tax stamps is given in [Annex D](#).

9 Finishing and application of tax stamps

When specifying tax stamps, the tax authority should:

- be aware of how the tax stamps will be applied to the taxable product;
- consult with manufacturers, distributors or importers of those products;
- consider capabilities in application methods and requirements for the speed of application;
- consider whether and how the tax stamp is to be tamper-evident;
- consider the ability to invest in the equipment necessary for applying tax stamps;
- impose requirements after consultation to ensure that these requirements are practicable;
- supply the finished tax stamp in different formats for application to different taxable products.

NOTE 1 As an example, a tax stamp designed to go over a bottle top onto hard metal and glass surfaces needs different adhesive requirements to a tax stamp on a soft cigarette pack.

Format decisions to be made cover topics, such as:

- the tax stamp substrate or substrates;
- how the tax stamps are supplied to the tax stamp applier, e.g. in reels, cut tax stamps, continuous rolls, sheets, bundled, boxed;
- the quantity per reel, batch, stack, etc.;
- whether they will be incorporated into other packaging components, e.g. shrink sleeves;
- the surface the tax stamp will be applied to and the method of adhesion, e.g. self-adhesive, wet glue, dry glue;
- any specific process or equipment requirements for the tax stamps, the reel or sheet for a particular tax stamp applier;
- where the UID is to be applied, e.g. at the printer, issuer or tax stamp applier (see [Clause 11](#) on UID);
- how the tax stamps are to be packed and shipped;
- the probable storage environment and whether this will affect the application performance of the tax stamps (primarily humidity and temperature).

The tax authority may set expectations or requirements for the amount of wasted tax stamps allowed in the application process and be alerted to excess wastage that may indicate possible fraud issues or inefficient application processes to be investigated.

NOTE 2 These points apply to pre-produced tax stamps, but some authorities create and distribute tax-paid indicia in the form of a pre-press file, for which different issues arise, primarily around the security of the digital file.

10 Tax stamp supply and distribution security

10.1 Production security

The tax authority should ensure that its suppliers are authorized security printers as tax stamps are value documents. A security printer is one that:

- uses equipment and components to produce secured documents;
- manages its operation to keep the document and data secure;

- has premises and staff security;
- has control and audit of production quantities, waste management and secure shipping.

Tax authorities may:

- inspect the supplier's premises to ensure that they operate securely;
- select printers who are recognized as security printers and as an authorized supplier to, for example, a central bank;
- verify that the supplier is certified as conforming to an appropriate national standard, such as ANSI-NASPO Security Management Standard 2015,^[8] or an international standard, such as ISO 14298.

For the production of material tax stamps that are not directly marked, the tax authority may conduct an inspection of a certified printer to ensure that sub-contractors or component suppliers operate adequate security procedures.

10.2 Distribution, issuance and activation security

10.2.1 General

NOTE This document refers to physical tax stamps and does not cover the procedures that a tax authority has in place to manage the tax stamp issuance, activation and tax collection. This subclause is included as best practice for system security because of the relationship between the tax stamp and tax collection and monitoring systems, which are not covered in this document.

As tax stamps are vulnerable to fraud and theft, tax authorities shall ensure the security of distribution and issuance procedures.

10.2.2 Issuance

The tax authority should control and monitor the way that tax stamps are issued to the legitimate tax stamp applier, which may be a producer, a packager, a filler or an importer. The tax authority may control the movement of tax stamps through the use of a UID (see [Clause 11](#)) or use control and audit procedures as practised by security printers conforming to standards, such as ISO 14298.

If a UID is issued as a distribution and issuance control, this process should include:

- assigning a UID to each tax stamp, with related codes assigned to the shipping container(s);
- planning, controlling and recording the distribution of these UIDs;
- controlling the printing of the UIDs;

The tax authority should ensure that tax stamps are issued only to legitimate tax stamp appliers:

- in accordance with authorized or audited production quantities;
- only after an approval of the issuance from the government-issuing authority;
- based on procedures that provide adequate security to deter, prevent, detect and mitigate the unauthorised production, release, diversion or theft of tax stamps, and that provide a system to detect any such action in a timely manner;
- when adequate auditing and control procedures allow for periodic audits of the provider's processes, to ensure compliance with the authorized production and issuance requirements.

The tax authority should ensure that personnel responsible for authorising tax stamp issuance and activation are:

- trained in security practices and auditing procedures;

- subject to criminal background checks unless prohibited by local privacy or data protection rules;
- hold appropriate security clearances, such as a government-issued clearance.

10.2.3 Activation

In establishing its tax collection system, and in specifying the controls required in the tax stamp supply chain, the tax authority should specify at which stage in the process the tax stamp is activated, the point at which the tax on the product becomes due, and at which point it is usually paid. Typical activation points are:

- when a material tax stamp is produced, if this is done on receiving an order from a tax stamp applier;
- when an order for tax stamps is received from a tax stamp applier, if material tax stamps are stored before delivery to a tax stamp applier;
- when a material tax stamp is affixed to a taxable product or when the tax stamp is direct-marked onto the product's container by a tax stamp applier; this may include a link between the UID and the relevant production and product details;
- when tax-stamped product is shipped to its first customer.

A tax authority should:

- record the activation of each tax stamp that becomes liable for taxation;
- tie the activation to the UID of the tax stamp (see [Clause 11](#)) or to the generation and printing of the UID when this is done simultaneously at the point of activation;
- consider whether to impose a time limit on the activation of applied tax stamps or UIDs to prevent fraud schemes involving tax stamps.

10.3 Procedures for unused or damaged tax stamps

The tax authority should require that any tax stamps that have been issued but that are damaged or otherwise not used be reclaimed or returned. If tax has been paid against the issuance of those tax stamps, it should require that it is credited to the taxpayer.

The tax authority should put in place a process to ensure that:

- unused tax stamps are either returned to the issuing authority or securely destroyed;
- unused tax stamps are de-activated and no longer serve as a tax invoice or receipt;
- the UID (if a UID system is in use) of any unused tax stamps is recorded as not in use to ensure that it is not re-issued and no tax can be expected to be received against it;
- returned, destroyed or unused tax stamps are properly audited and accounted for;
- any tax paid on the issuance of the unused tax stamps is refunded or credited to the taxpayer's account.

If material tax stamps are to be destroyed and not returned, the tax authority should:

- specify which organization is responsible for their destruction;
- ensure that destruction is genuinely secure so that no tax stamp can be reconstructed;
- recall any tax stamps if necessary, applying the same system for the secure return, destruction and accounting of tax liabilities to the tax authority.

11 Serialization and unique identifiers

11.1 Serialization of tax stamps

The tax authority should require that each tax stamp has a UID, also referred to as a serial number, to enable checks on the payment of the required tax.

NOTE The generation and application of this UID can take place at different stages of the process according to the tax system and the information required on the tax stamp.

The tax authority, supported by appropriate legislation, should determine with the supplier where and how in the process this will be done, whether:

- during the tax stamp production process as a function of a production cycle of tax stamps by the tax stamp producer or a third party serialization or coding organization;
- during the tax stamp production process as a consequence of a tax payment or order from a tax stamp applier, by the tax stamp producer or a third party serialization or coding organization;
- by the issuer of the tax stamp as confirmation of a tax payment against which the tax stamp is issued; or
- at the point of application of the tax stamp in relation to activation or as confirmation of a tax payment.

In all cases, the tax authority should ensure that tax stamps are accounted for. UID-generation models before tax stamps are shipped for application require different controls to models where the UID is generated and added during production or otherwise at a centralized storage and issuance site.

11.2 UID formats

The tax authority should decide at an early stage of the specification of its tax stamps:

- how the UID will be used;
- what it contains;
- how it is generated;
- how it is integrated in the tax stamp.

NOTE The decision will reflect input from stakeholders after consultation in accordance with [Clause 7](#).

The tax authority may use UIDs with:

- numbers only or a combination of letters and numbers (alphanumeric);
- sequential or random (or apparently random) codes or numbers;
- a combination of random and sequential numbers or letters and numbers;
- printed on to the tax stamp in plain text (human readable) or as an encrypted sequence, or both;
- human or machine readable, or both;
- a sequence of batch and unique numbers, where batch numbers record characteristics of the taxable product, such as manufacturer, product type and production site; and/or
- a code that follows or meets appropriate standards or a proprietary code of a type generated only by a specific company or its licensees.

Sequential serialization can be printed with simple numbering wheels, whereas random numbers require algorithmic or physical generation. Encryption, electronic signatures, visible digital seals and comparable technologies improve the security and thus the level of confidence in UIDs.

The tax authority should also ensure that the chosen UID method conforms to ISO 22381 so that it is interoperable with other UID systems used for product identification and authentication.

12 Examination of tax stamps

12.1 Levels of examination

A tax authority should consider:

- how and by whom tax stamps will be examined to ensure that they are legitimate;
- the level of motivation, knowledge, training and equipment of each examiner, who may be consumers, law enforcement officers or forensic laboratories.

To expand on the tax authority's responsibility, it should consider several characteristics of the examiner, including:

- their level of motivation or commitment to the examination;
- examination knowledge and experience;
- familiarity with the tax stamp's security features;
- access to training and examination tools, including genuine tax stamps to use as a reference tool.

NOTE The levels of examination for tax stamps therefore include:

- Level 1: rapid inspection by human senses using easily identifiable overt features;
- Level 2: examination of covert features by trained inspectors using a tool or device;
- Level 3: authentication of coded covert security features or the encoded UID using a dedicated tool or app (which may also enable tracking and tracing of the tax stamp);
- Level 4: forensic examination.

The tax authority should not depend on consumers for the verification or authentication of tax stamps. While this could change in future, consumers rarely carry out anything more than a cursory examination, but could be encouraged to conduct a Level 1 examination.

12.2 Means of authentication

NOTE There are three aspects to authenticating tax stamps: material features, the means to examine them (human senses, tools) and digital analysis. Tools can be standalone, can reveal features to the human senses, can process information from the material features or can connect to a data store or processor to process information.

12.2.1 Characteristics

The tax authority should identify authentication tools that enable the examiner to inspect the authentication features appropriate to their inspection level and display the result to the examiner. Authentication tools may be available off-the-shelf or be proprietary. Factors to consider include:

- the security and reliability of the tool;
- portability;

- the requirement for power, battery or mains;
- immediacy of the authentication result;
- the requirement for a network connection and the consequence should it not be available;
- the environmental conditions of the examination;
- to whom the tool(s) will be issued (for example, the tax authority examiners or customs officers)
- the training required to use the tool;
- the cost of using the tool.

12.2.2 Smartphones

The tax authority and other organizations may establish tax stamp examination regimes that include the option of using smartphone applications.

With the use of applications appropriate to the tax stamp's security features, the public or trained examiners can use smartphones to examine specific tax stamp features. Smartphones may be able to:

- examine and validate the authentication feature without recourse to a network connection, using the camera, data storage and processing capacity of the phone;
- register and decode the UID or other features on a tax stamp, then access a central or distributed database remotely to check if the UID is valid, associated to the right product and found in the expected location.

The tax authority should:

- consider the extent to which the public is required, motivated or expected to examine tax stamps before selecting the authentication feature or smartphone application combination to use;
- consider smartphone applications able to support both online and offline authentication;
- define requirements linked to consumer or professional examination.

Smartphone applications can be an important examination tool for trained examiners, but the tax authority should be aware, when selecting authentication and smartphone readability, of the vulnerabilities of network systems and the value, therefore, of using apps that can authenticate without a network connection.

It can be advantageous for the tax authority to ask the public to examine tax stamps using a networked app, as this allows the authority to gather data about the consumption of taxable products. The authority can establish a data store to which the app connects, so information, such as the location of the sale and other data, can be captured for analysis. The tax authority may wish to consider ways to encourage the public to use these apps to examine tax stamps and to offer a reduction or refund of the tax for using the app. More information is given about the appropriate tools and examination level in [Annex G](#).

12.3 Forensic analysis

Tax authorities should consider which elements of their tax stamps are suitable for forensic analysis and should ensure that there is a record of the analysis of those elements for comparison with suspect tax stamps.

NOTE Forensic examination can demonstrate whether an item is genuine or not by analysing its composition and comparing it with the composition of a known authentic item.

In the case of tax stamps, any or all of the substrate, the inks and the authentication features might be subject to forensic analysis. The advantage of forensic analysis is that it is normally carried out by

a specialist laboratory by technicians trained in handling evidential material, so this provides court-admissible evidence in the event of a prosecution.

13 Monitoring and assessment

13.1 General

The tax authority should establish appropriate monitoring and assessment of its tax stamps, tax stamp programme and supply procedures. These should allow it to assess the effectiveness of the tax stamp programme and find ways to overcome identified weaknesses.

NOTE This will establish the importance of monitoring the performance of the tax stamps in an iterative process that enables a constant improvement in that performance.

13.2 Fit-for-purpose testing

The tax authority should:

- include fit-for-purpose or adversarial testing in its tax stamp procurement and monitoring programmes;
- have the testing done by a government agency in the jurisdiction with the appropriate competencies or by an independent private entity certified as independent of any vendor in the tax stamp process and independent of any stakeholder, manufacturer or importer;
- consider the organization's suggestions on methods criminals might use to attack tax stamps, such as printing the tax stamp and replicating the security features, interfering with or penetrating the IT systems of the tax authority and other possible fraud methods;
- carry out fit-for-purpose testing before the tax stamp is released in to the system to ensure there are no obvious vulnerabilities.

NOTE Adversarial testing is a measure of the resistance to fraudulent attack of all authentication and information technology (IT) elements used on, or in a tax stamp. This testing could require assistance from one or more government stakeholders. Adversarial testing provides the tax stamp issuing authority and those who rely on them with assurance or verification prior to issuance so that the authentication and IT element solutions built into the tax stamp are able to resist all forms of fraudulent attack in accordance with the specified expectations.

All testing should be carried out in accordance with a specification of resistance and test expectations reviewed and should be approved by the tax stamp issuing authority. It should include an assessment of the degree with which information on materials, technologies and devices used in each authentication or IT element (solution) are available to potential attackers.

The testing regime should look at:

- the difficulty of counterfeiting the whole tax stamp;
- the difficulty of altering a tax stamp, in particular the UID;
- the difficulty of removing a tax stamp to put it on an illicit product;
- the ease of identifying a counterfeit, altered or fraudulently placed tax stamp;
- any conditions that could affect examination of the tax stamps.

The tax authority should develop a procedure for use when testing finds that tax stamps do not meet requirements or are not adequately resistant to copying.

13.3 Quality control and compliance

The tax authority or other procuring agencies should:

- periodically examine tax stamps from various points in the supply chain to ensure that they comply with the requirements set out in the contract;
- establish contractually acceptable tolerances in consultation with the tax stamp provider considering the unavoidable variations in materials and components;
- consider procedures for, and encourage, stakeholder reporting of suspicious tax stamps through information campaigns on how to identify a genuine tax stamp.

Annex A (informative)

Request for proposal

There is guidance from the UN and many national governments on how to draw up a public sector RFP. See Reference [9] for the UN guidance.

All tenders should incorporate the anti-bribery provisions found in ISO 37001, including:

- establish, implement, maintain and improve an anti-bribery compliance programme or management system;
- measures and controls that represent global anti-corruption good practice.

In Reference [10], the OECD identified integrity risks related to the pre-tendering, tendering and post-award phases of the procurement processes that are useful in guiding public and private sectors through many of the integrity risks associated with public procurement.

All tenders should include integrity risk mitigation elements. Bidding vendors should certify (in writing) that neither they, nor any partner or vendor part of the offering, is currently under any fraud or corruption investigation, or have been found guilty, pled guilty or pled “no contest” to any fraud or corruption offence in the past five years in any jurisdiction.

For further information, see References [11] to [13].

In order for suppliers to submit realistic proposals, the RFP should include:

- yearly volumes by size and location of application sites;
- types and/or categories of products to which tax stamps are to be applied;
- physical forms of tax stamps;
- requirements for secure distribution;
- physical and digital properties in application;
- IT systems: secure data management and storage, security, disaster recovery, integration and reporting.

On a process level, the RFP should include, but not necessarily be limited to, aspects of:

- tax stamps and print;
- UID and data management;
- issuance processes;
- application processes;
- control and examination processes;
- outputs of the system.

The life span of the project should be specified, including:

- timing of the implementation phase;

- guaranteed minimum duration of working with a solution and supplier(s) selected, and optional continuation periods;
- phase-out timing.

In suggesting a minimum duration, a balance is desirable between the supplier's return on investment in the project for best price/value ratio and openness to innovation for new generation suppliers.

It is recommended to include in the RFP clauses that cover risk factors, such as raw material and labour price changes, natural catastrophes, political changes and other types of risk. Also, it is recommended to carefully assess the financial capacity and the relevant experience of the supplier, to minimize the risk of deployment, operation and customer support failure, for example by requiring to audit the supplier.

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Annex B (informative)

Design and construction

In this annex and the following annexes, material and technology innovations and developments should be considered while reading or referencing the annexes.

Examples of design and construction are given in [Figure B.1](#).

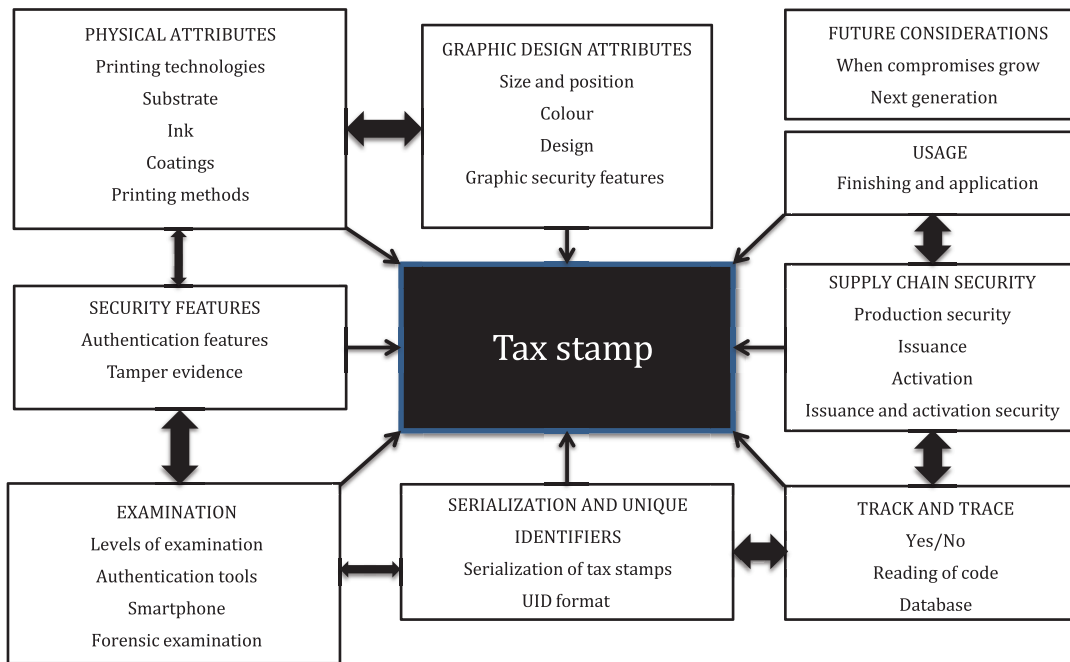


Figure B.1 — Examples of tax stamp design and construction aspects and their interdependence

Annex C **(informative)**

Substrate materials

C.1 Paper substrates

Paper is the traditional material for tax stamps. Most paper is made from wood pulp, but security papers could be made from a rag pulp, or a mixture of wood and rag pulp, which makes them more durable. Therefore, rag paper is used largely for banknotes. Paper can incorporate one or more security features, including, but not limited to, security threads, fibres, micro-cuts, watermarks and reactive indicators.

One important characteristic of paper that serves as a security feature is that printed inks penetrate the top surface, making it more difficult to remove or alter the design on the tax stamp.

C.2 Synthetic substrates

C.2.1 Synthetic papers

Synthetic papers are mainly made from thermoplastic, which is engineered to resemble paper in the surface characteristics, so that they are suitable for printing on but are typically more tear-resistant and more durable than paper made from pulp or rag. Synthetic papers are mainly proprietary products sold under a brand name.

Synthetic paper can be engineered with a micro-porous matrix that locks in inks and toner, rendering printed information highly resistant to scrapes, scuffs and other damage, which can also be embedded with application- or customer-specific security features.

C.2.2 Polymer substrates and films

Polymer substrates and films are transparent or opaque polymer sheet materials treated to have a printable surface, which are more tear-resistant and more durable than paper. Filmic materials are also used for, but not limited to, shrink caps, wrappers and labels with colour changing tamper-evident effects.

C.2.3 Laminates

Recently, security substrate manufacturers have developed laminated materials that combine polymer and paper layers, to give the durability and tear-resistance of polymer with the printability of paper.

C.3 Tamper evidence

The above materials can be constructed so that they provide tamper evidence.

Annex D (informative)

Comparison of substrate-based tax stamps and direct marking

Note that material or technology developments can alter the contents of this annex at any time. [Table D.1](#) gives a comparison of tax stamps. [Figure D.1](#) gives an example of an outline process flow. Features are described in [Annex E](#) and are not listed here in any security value ranking.

Table D.1 — Comparison of substrate-based and direct marked tax stamps

| Security category | Features | Substrate-based tax stamp | Direct marking |
|--|---|---------------------------|----------------|
| Digital | Invisible encrypted machine-readable code | Yes | Yes |
| | Visible encrypted machine-readable code | Yes | Yes |
| | Visible non-encrypted QR codes | Yes | Yes |
| | Visible alphanumeric code | Yes | Yes |
| | Copy-sensitive codes | Yes | Yes |
| | Substrate biometry | Yes | Yes |
| | Forensic markers | Yes | Yes |
| Material | Inkjet, flue, taggant inks | Yes | Yes |
| | Fingerprinting | Yes | Yes |
| | Optically variable inks | Yes | Yes |
| | Intaglio inks | Yes | No |
| | Hologram | Yes | No |
| | Optical elements | Yes | No |
| | Microtext/minitext | Yes | No |
| | Guilloche | Yes | No |
| | Microcuts | Yes | No |
| | Cutting | Yes | No |
| | Substrate | Yes | No |
| | Activation | Yes | Yes |
| Functionalities | Traceability | Yes | Yes |
| | Anti-tampering | Yes | No |
| | Use as a seal/closure | Yes | No |
| | Contactless method of application | No | Yes |
| Security printing certification possible | | Yes | Not applicable |

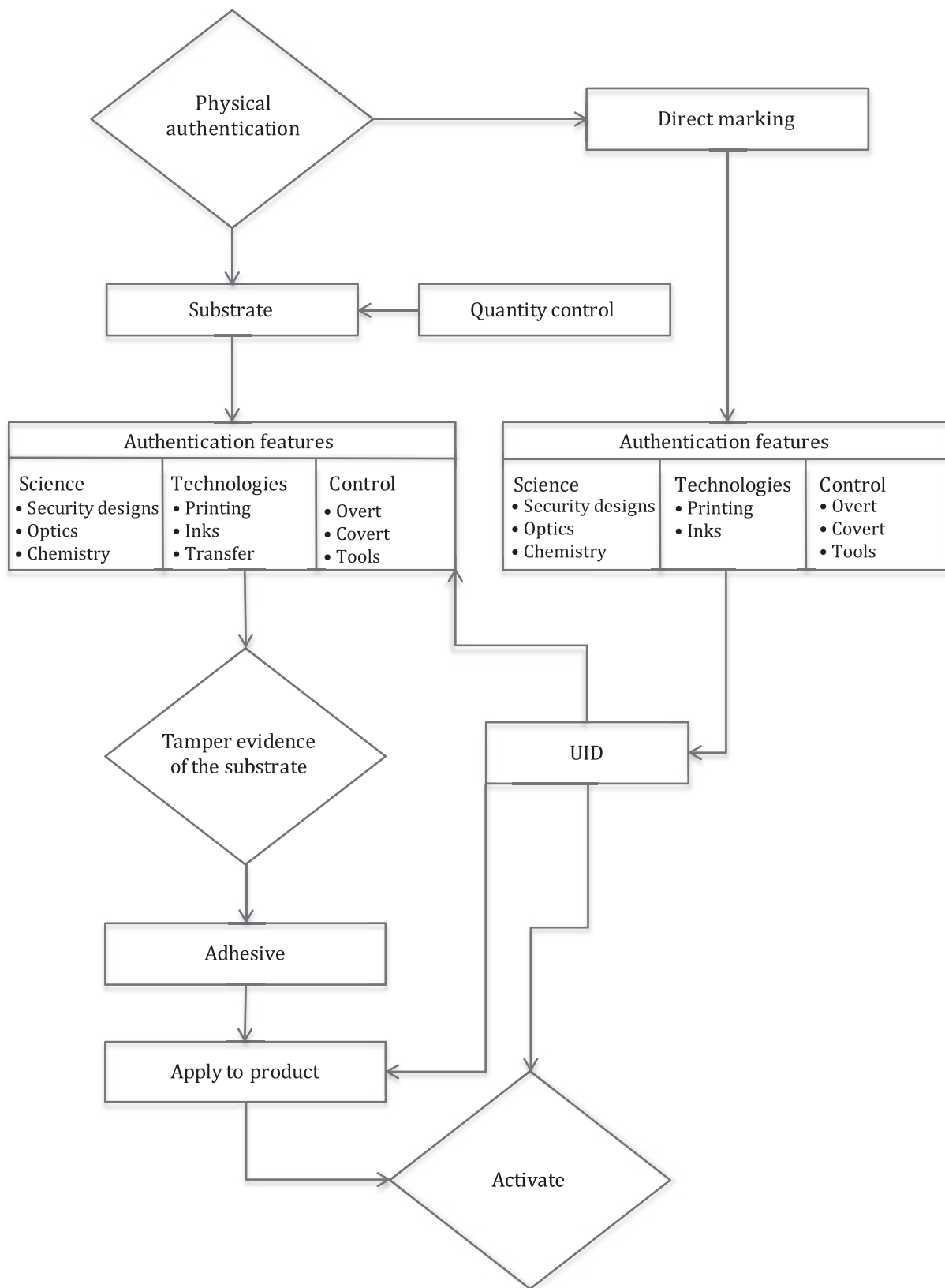


Figure D.1 — Example of outline process flow for material tax stamps and direct marked tax stamps

Annex E (informative)

Authentication features

E.1 General

This annex gives more detailed information on the authentication features that can be included in tax stamps. This primarily applies to material tax stamps, although taggants and special inks can be used in directly marked tax stamps.

As stated in [Clause 8](#), the best protection against fraudulent material tax stamps is achieved by producing the tax stamps on a material specified as a security substrate, using security inks to print the visible graphics and covert graphic elements, and adding to the tax stamp authentication features that combine (whether in a single component or through different components) overt and covert elements. The authentication feature(s) may also carry, overtly or covertly, the UID, which is printed on the tax stamp to enable cross-checking of the two (or more) UID versions.

The design of the graphics and authentication features is an important part of the security strategy for tax stamps. There are overt and covert features, which can be generated by dedicated software for printed graphics and holograms, so these authentication features should be custom-designed for each security project and should not be off-the-shelf materials.

This also applies to other authentication features, such as taggants and tamper-revealed features, where much of their security value lies in the fact that they are not readily available on the open market nor easy to simulate with non-specialist products.

This annex lists and explains these authentication features. Tax authorities should note that this is a field of rapid development and innovation, so it is probable that new features or technologies will be available within the lifetime of this document. Each extra feature used on a tax stamp adds a hurdle for criminals to overcome, a hurdle which is even higher if the features require quite different production equipment. So the tax authority should define the number of features and level of complexity required.

The tax authority should ensure that suppliers of these components operate in secure conditions and use only secure shipping processes.

E.2 Overt authentication features

There are several categories of overt features that can be used on tax stamps. These mainly require visual examination, but some use the sense of touch. The broad categories include:

- printed as part of the graphic design;
- inks specifically formulated to produce some of these printed features;
- holograms, or similar diffractive optically variable image devices (DOVIDs), which may form the tax stamp's substrate or otherwise be added in the form of a foil patch or stripe;
- lenticular laminates.

NOTE The presence of a visible UID is also an overt feature, but its main characteristic is to point to information in a database (see [Clause 11](#)).

E.3 Graphic features

E.3.1 General

Graphic features include those given in [Table E.1](#).

Table E.1 — Graphic features

| Name | Description |
|---|---|
| Colour changing effects — angle-dependent | Change colour when viewed under a different angle and can be combined with a latent image (see below). |
| Colour changing effects — thermochromic | Temperature-sensitive inks that change colour when heated or cooled to a typically non-ambient temperature. |
| Latent image | Either a printed line pattern that reveals a different image when viewed at a shallow angle across the document, e.g. printed by intaglio as a raised tactile feature, or an image in a hologram revealed only by viewing in a specific way. |
| Guilloches | Patterns of fine interlaced lines consisting of several geometrical structures printed in multiple non-standard colours using offset or intaglio process. Multicolour line patterns with internal crossed lines are effective against copying with standard commercial reproduction techniques. |
| Rainbow printing | A printing technique where one ink is gradually mixed with the next ink so that the colour fades from one to the other so that the image will be printed in rainbow colours. |
| Tactile patterns | Specific ink printed with high relief (approx. 40 micron) using intaglio or screen printing process, which can easily be authenticated by touch. Can be combined with latent image. |

E.3.2 Holograms

The following types of hologram can be used as an authentication feature on tax stamps.

- Surface relief holograms, produced on a thin thermoplastic film, such as polyester, often with a metal coating to give a mirror-like effect. This is the most familiar type of hologram used for authentication, with its rainbow-like colours.
- Photopolymer holograms, produced in an emulsion on a thin film, giving images having a more obvious three-dimensionality in one or more colours.

Holograms can incorporate numerous overt effects intended for verification by naked eye, which may include:

- three-dimensionality, showing depth and parallax in the image;
- dynamic effects, where the image or parts of the image change or move as the hologram is tilted or rotated;
- colour effects, where colours change or alternate between positive and negative as the hologram is tilted or rotated, or where there is an absence of colour to give white or achromatic image areas;
- guilloches (see [E.3.1](#)) as a fine-line pattern in the hologram.

There are different techniques for producing these effects, some of which are not actually holograms in the scientific meaning, but the word “hologram” has come to be used to refer to all similar DOVIDs. See [E.4](#) on covert features that can be incorporated into holograms.

The tax authority should require the hologram manufacturer to register their holograms in the Hologram Image Register of the International Hologram Manufacturers Association, or a similar register of security holograms, to prevent inadvertent reproduction of the hologram.

E.3.3 Other optical effects

There are other methods of making optically variable thin films that can be used on tax stamps (although to date they have not been as much used as holograms). Examples are:

- liquid crystals, which exhibit a changing flat image;
- refractive coatings, which appear as an iridescent effect;
- lenticular laminates carrying images that seem to float above or below the substrate.

E.4 Covert authentication features

E.4.1 General

There is a wide variety of covert authentication features suitable for tax stamps, which can be incorporated into the printed graphics, mixed into or added to the substrate, or applied on the tax stamp. The tax authority should select the covert feature most appropriate to its examination environment and then ensure that examiners are trained and equipped as necessary. In selecting covert features, the authority should consider whether it wants these to be separate from or combined into the overt features.

E.4.2 Graphic features

There are several types of inks, toners and dyes that can be used to print covert elements, including human-visible and human-invisible inks that react to light of specified wavelengths, other electromagnetic stimuli or temperature, and inks that change appearance when viewed through the required filter (such as a credit-card size, or smaller, lightweight plastic lens).

Inks used for security documents include those given in [Table E.2](#).

Table E.2 — Inks used for security documents

| Name | Description |
|----------------|---|
| Fluorescent | Visible inks which change colour, or invisible inks which appear or reveal distinct visible characteristics, when illuminated with ultraviolet (UV) light. |
| Bi-fluorescent | Fluoresce in different colours under two different wavelengths, such as short- and long-wave UV. |
| Phosphorescent | Fluoresce under UV light but continue to emit visible light for a period of time after the UV light is removed. |
| Up-converting | Change colour, appear or reveal distinct visible characteristics when illuminated with infrared (IR) light; this is a more difficult phenomenon to achieve than fluorescence, so a rarer and therefore more secure ink. |
| Polarizing | Containing a polarizing feature so that a new image is revealed when the print is viewed through a polarizing filter or using a polarizing light source. |
| Metameric | A pair of printed images that appear the same colour under white light but show different colours when viewed through a filter. |

Covert graphic features are parts of the tax stamp requiring a small tool or instrument to detect. Some are proprietary and require a proprietary reader or decoder, others are generic. Covert graphic features include those given in [Table E.3](#).

Table E.3 — Covert graphic features

| Name | Description |
|-----------------------|---|
| Microtext | Very small alphanumeric characters that are too small for the naked eye to see as discreet characters, so they are often patterned so they appear as a line. Require a hand-held loupe (or magnifying glass) to be read. |
| Digital watermarking | Information is embedded into printed digital images so that it is invisible to the human eye, requiring a dedicated reader to reveal it. |
| Screen-decoded images | Hidden images embedded into printed digital images that require an optical filter to view; this filter is usually a pocket-sized hand-held lens of an appropriate type and there are many techniques to achieve these images. |

Encrypted codes and UIDs can be printed with covert security inks to restrict authentication to law enforcement inspectors. Such covert codes can act as a key to allow such inspections to retrieve tracking and tracing data.

E.4.3 Holograms and other DOVIDs

As well as showing an overt image or design, DOVIDs can incorporate covert elements, which can include those given in [Table E.4](#).

Holograms can also carry a UID or other variable elements as a visible surface image or optically encoded.

Table E.4 — DOVIDs with covert elements

| Name | Description |
|-----------------------|---|
| Micro- or nano-text | Similar to microtext above, except that these optical devices allow much smaller characters to be created, as small as 5 µm, which requires a microscope to view. |
| Nano-images | Images which require a magnifying glass or microscope to view. |
| Laser images | Parts of the DOVID that are displayed only when illuminated by light of a specific wavelength, usually from a small laser or LED, such as a laser pointer. |
| Polarized image | Part of the DOVID that is recorded in polarized light, which therefore requires a polarizing filter (a small plastic film) to be placed over it to reveal it. |
| Screen-decoded images | As above, hidden images embedded into DOVIDs. |
| Proprietary | There are other methods of incorporating covert image elements in to a DOVID that are proprietary. |

E.4.4 Taggants

Taggants are microscopic particles that can be added to the substrate, inks, hologram or coating that are only detectable by the appropriate device. Some taggants give a simple yes/no response (yes means the taggant is present, no means it is absent), others can be configured in such a large number of variations that they can be made specific to an individual item, such as a tax stamp for a product from an individual producer.

Most taggants are proprietary and therefore require a proprietary tool. They include organic and inorganic compounds.

E.4.5 Unique material pattern

Unique material pattern capture (also called “fingerprinting”) is the process of capturing an image or other data related to a defined area of the tax stamp. This image or data will be unique, not repeated anywhere else on that surface (or the surface of any other tax stamp) because of the randomness of the structure.

These data are stored either in their original form or converted to a code (which includes the location of the area that was recorded). This can be printed on to the tax stamp (usually as a data matrix code)

or stored on a database. The tax stamp is authenticated by re-acquiring the data from the same defined area to compare with the original data. If the two match, the tax stamp is genuine. If they don't match, the tax stamp is probably fraudulent.

E.4.6 Copy-sensitive codes

A copy-sensitive code is a printed, engraved or holographic code in the form of a matrix of dots or other elements containing data which is originated as a digital image. To produce a copy, a counterfeiter must scan and re-print or re-engrave a scanned version of the code as the original matrix cannot be re-originated. As the original matrix cannot be re-originated due to encryption and stochastic physical imperfections, a copy is detected using a tool that measures the loss of information within the copied symbol.

Such codes are based on a physical principle related to the concept of "critical resolution of a process" or physical unclonable function (PUF).

Annex F (informative)

Examples of printing techniques

It is helpful for tax authorities, when specifying their tax stamps, to understand the different printing technologies and options that are available before consulting suppliers. [Table F.1](#) gives a summary of the main printing processes used for tax stamps.

Table F.1 — Examples of printing techniques

| Name | Description |
|-------------------|--|
| Offset printing | Offset printing is the most commonly used printing technique for tax stamps. Offset printing equipment is widely commercially available, with the consequence that it is vulnerable to counterfeit. For that reason, offset should be combined with other printing techniques such as intaglio, screen printing, or additional digital security or optical security features. |
| Intaglio printing | The intaglio printing technique is mainly used for security documents because of the complexity in the process, which requires an engraved or etched plate and very high pressure to push the paper against the plate. This technique can print tactile elements and continuous-line patterns with the highest resolution (because it does not use dots to make up the printed image). |
| Screen printing | Screen printing technology is used only in combination with other printing techniques for the application of security inks, such as iridescent inks, optically changeable inks and liquid crystal inks. |
| Flexo printing | Flexo printing is mainly used for label and packaging solutions. It is comparable with the offset technique and has the ability to bring more ink to paper, which can be an advantage for security solutions. |
| Inkjet printing | On tax stamps, inkjet printing is the most suitable technology for applying the UID on the label or direct to the container or pack. |
| Digital printing | Digital printing refers to printing from a digital image, without a printing plate or screen, so that variable content can be included on the item printed. Digital printing includes inkjet, laser, thermal and other methods. |

Annex G (informative)

Authentication tools and usage

The selection of the authentication tools depends on the type of inspection, context and the type of authentication elements.

Authentication tools appropriate for the authentication features on the tax stamps to be examined should be issued to the relevant inspectors, taking into consideration the following constraints: usage rights, availability, reliability, security, data transmission (see [Table G.1](#)). Inspectors should be trained to acquire specialized knowledge for appropriate usage and reliable authentication results, depending on the authentication tools.

Table G.1 — Appropriate examination tools by type of examiner

| Inspection/context | General audience | Restricted audience | | | |
|---|------------------------------|---------------------------------|---|--------------------------------------|-----|
| | End user: retailer, consumer | Distribution and supply network | Tax inspector, customs, other law enforcement officer | Rights' holder or its representative | Lab |
| Authentication element examined by: | | | | | |
| Human senses | Yes | Yes | Yes | Yes | Yes |
| Stand-alone or networked authentication tool plus specialized knowledge | Rarely | In some circumstances | Yes | Yes | Yes |
| Forensic equipment | Not applicable | Not applicable | Yes | Yes | Yes |

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