TECHNICAL REPORT

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Direct Marking on Plastic Returnable Transport Items (RTIs)

Inscription directe sur les éléments restituables en plastique de transport (RTIs)

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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote. 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.

In exceptional circumstances, when the technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide to publish a Technical Report. A Technical Report is entirely informative in nature and shall be subject to review every five years in the same manner as an International Standard.

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ISO/TR 17350 was prepared by Technical Committee ISO/TC 122, *Packaging*.

Introduction

The typical returnable transport item (RTI) used in physical distribution is a pallet. In the logistics industry, however, carton boxes, which are normally loaded on a pallet and tightly bound with a rope or net, are traditionally used. For environmental reasons, in recent years, these carton boxes are being replaced by plastic RTIs (returnable box). This is a growing trend, especially in the manufacturing industry, where RTIs are regarded as an important delivery means in the transportation between production sites and where RTIs are implemented for carrying items from the distribution centre to the retailer.

However, the lack of a well-established structure to control RTIs (owner management) has created problems resulting in uncontrolled, discarded, lost or stolen RTIs. Generally, in supply chain management, an RTI filled with items is exchanged among the trading partners in the conventional forward logistics and the same RTI is emptied and collected for reuse in the reverse logistics (return process). Because no efficient RTI management system currently exists, collection of RTIs has not been successful and this is adversely affecting the efficiency of the overall shipping process. An ideal solution would be the use of an identification code to uniquely identify individual RTIs.

Data carriers for this potential management system could include OCR, linear symbols, two-dimensional symbols or RFID. The use of an OCR-based reader is not recommended because of its cost and linear symbols are not practical for storing a large amount of data. Taking these factors into consideration, a 2D symbol may be a reasonable choice for marking RTIs.

Two methods are available for applying 2D symbols on RTIs; labelling and direct marking. Most labels are accompanied by the risk of peeling off during a long cycle of reuse, but using a highly durable label that resists peeling comes at a higher cost. For that reason, this technical report proposes marking 2D symbols directly on the RTIs. And because a variety of colours are used for RTIs and achieving a 100 % read rate for some colours is nearly impossible, this technical report is intended to provide guidance to determine the most appropriate marking and reading method for resin-made RTIs.

This Technical Report contains 15 annexes, all of which provide informative information:

Annex A — Example of serial numbers (SNs)

Annex B — Example of structured data

Annex C — Specification of hand-held scanner

Annex D — Specification of hand-held terminal

Annex E — Specification of fixed scanner

Annex F — Specification of LED light for fixed scanner

Annex G — Specification of verifier

Annex H — Specification of LED light for verifier

Annex I — Specification of FAYb laser

Annex J — Specification of CO2 laser

Annex K — Specification of dot peen maker

Annex L — Types of LED light

Annex M — Evaluation results on samples A

Annex N — Evaluation results on samples B

Annex O — Evaluation results on samples C

Direct Marking on Plastic Returnable Transport Items (RTIs)

1 Scope

This Technical Report provides guidance on

— Returnable transport items (RTIs)

— Identification codes used for RTIs

— Specifications for two-dimensional symbols

— Method for direct marking

— Reading method for direct marking

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 445, *Pallets for materials handling — Vocabulary*

ISO/IEC 19762 (all parts), *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*

ISO 21067, *Packaging — Vocabulary*

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions, and abbreviations given in ISO/IEC 19762 (all parts), ISO 445 and ISO 21067 apply.

NOTE Within this document, “NG” is an abbreviation for “no good”.

4 Types of Returnable Transport Items (RTIs)

The term Returnable Transport Items (RTIs) typically refers to logistics materials used among suppliers for shipping (transferring) parts/components and assemblies. The purpose of this technical report is to recommend a method to identify RTIs for the establishment of an RTI control system that can be shared throughout the industry. However, considering the fact that RTIs of different sizes and materials are used in the market, it is difficult to apply the same definition to all the types of RTIs. The focus of this report is on the typical RTI characteristics as defined below.

4.1 Pallets

Figures from 1 to 7, below, show typical examples of pallets, which include a flat pallet, roll box pallet, box pallet, post pallet, silo pallet, tank pallet and sheet pallet. In the manufacturing industry, pallet-formed RTIs specially designed for the industry are widely implemented (see Figure 7). This technical report applies to RTIs illustrated in Figures 1, 3, 4 and 7.

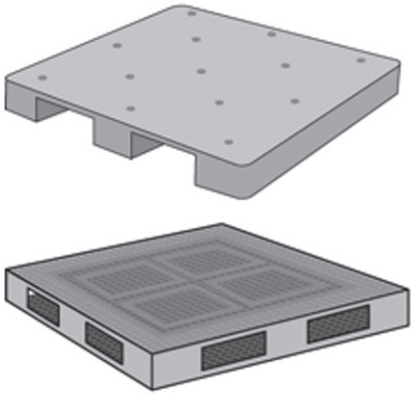

Figure 1 — Plate pallets

Figure 2 — Roll box pallet

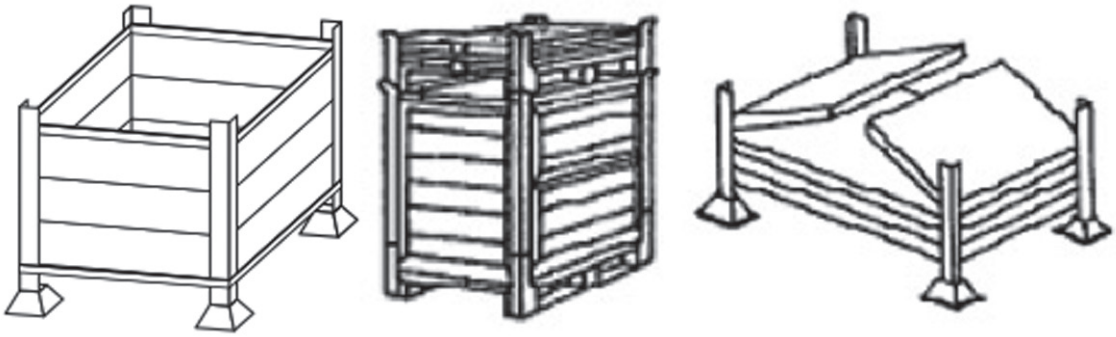

Figure 3 — Box pallets

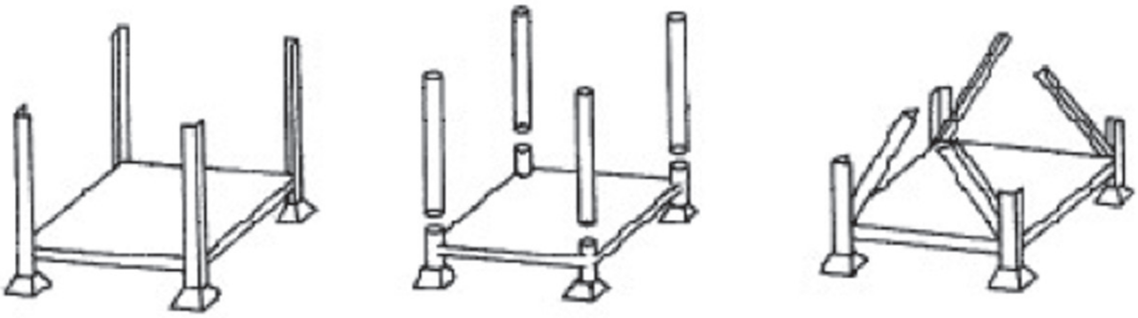

Figure 4 — Post pallets

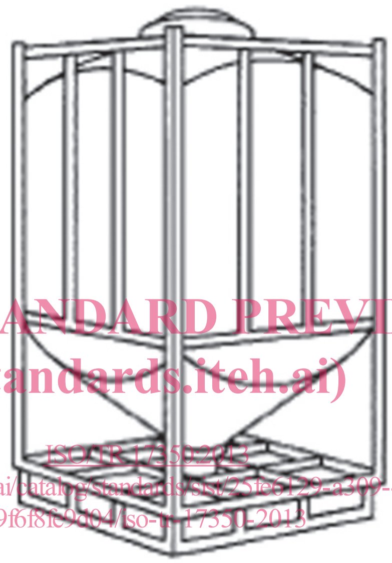

Figure 5 — Silo pallet

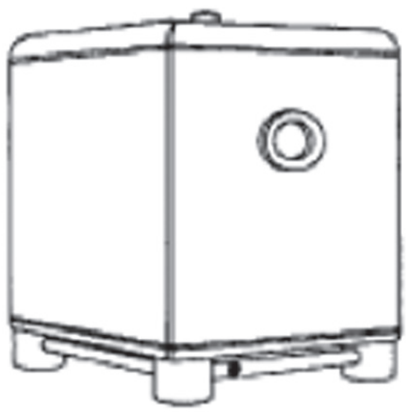

Figure 6 — Tank pallet

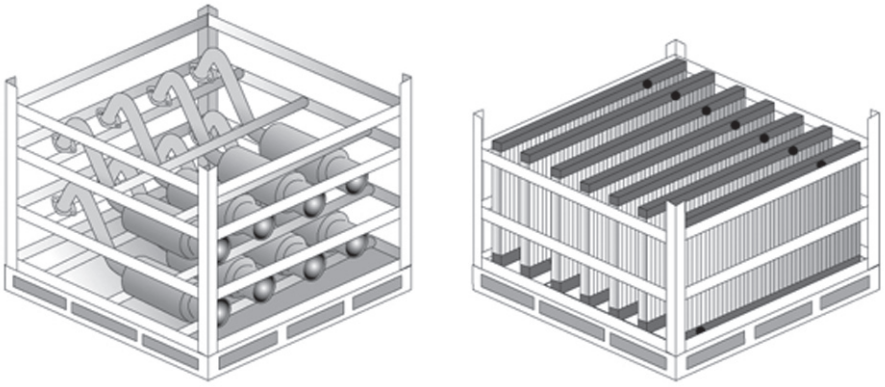

Figure 7 — Special pallets

4.2 Sheet pallet (Slip sheet)

A sheet pallet, or a slip-sheet, is a sheet-like packing material that is used instead of a plate pallet when loading a returnable box on a carrier vehicle, such as a truck. This sheet pallet facilitates easy handling of the returnable box by reducing a friction generated between the returnable box and the undercarriage of the truck. By pulling the tab of the sheet pallet, the returnable box is smoothly unloaded from the truck without difficulties. The sheet pallet can also be used under the returnable box (see Figure 8). This technical report is also applicable to the sheet pallet in Figure 8.

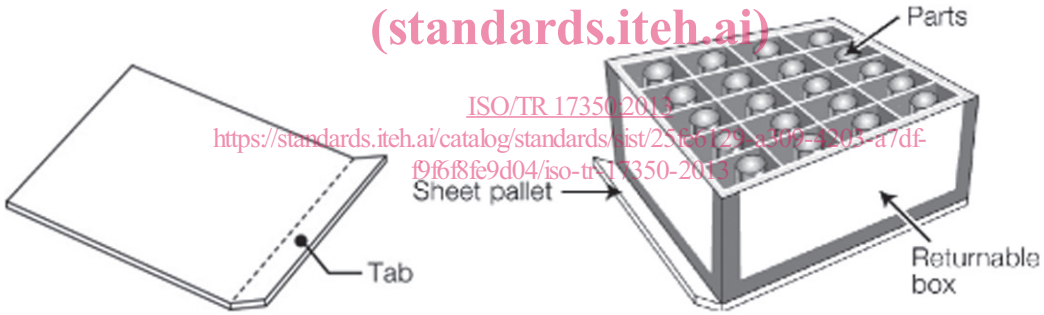

Figure 8 — Sheet pallets

4.3 Returnable boxes

Figures 9 and 10 below show typical examples of returnable boxes, including those for carrying multiple objects on a flat pallet. Metallic drums and barrels used for liquids, oil or powders are not included in this technical report. It does, however, apply to containers for carrying non-solid substances such as beverages, detergent or coating materials.

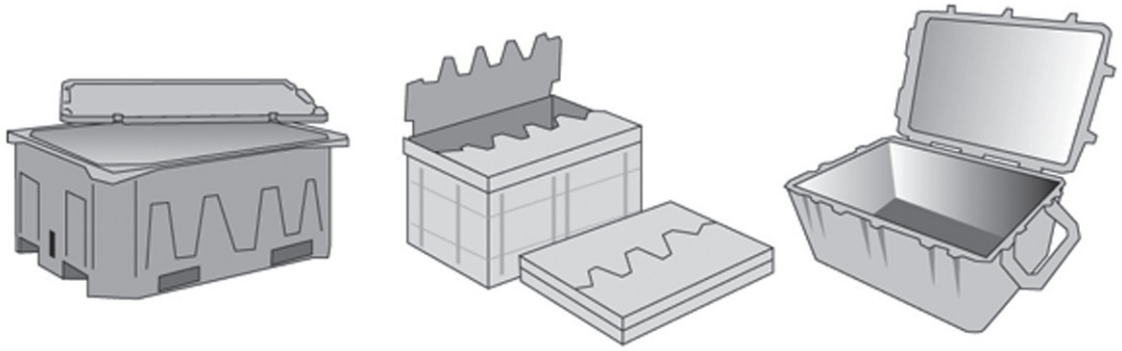

Figure 9 — Large-sized returnable transport items

Figure 10 — Medium-sized returnable transport items

Figure 11 — Liquid containers, like metallic drums

4.3.1 Plastic returnable containers

Plastic returnable boxes, made mainly of polypropylene, have been widely used for carrying beer for more than 20 years and they are now regarded as a typical RTI. Since its first appearance, the plastic container has been recognized in the logistics industry as an alternative to the cardboard box or wooden crate.

4.3.1.1 Applications

The largest application for plastic returnable boxes is to store and/or deliver parts and components for vehicles and electronic home appliances. This is followed by applications in the grocery supermarkets and convenience stores.

Table 1 — Typical applications for plastic containers

Application	Examples
Manufacturing	Storage or delivery of parts/components used in vehicles and electronic home appliances
Logistics	Apparel, convenience stores and supermarkets
Others	Agriculture and fishery

The use of plastic returnable boxes is effective only if a well-established system for collecting and reusing them is provided as part of the shipping process. In general, the plastic returnable boxes currently seen on the market come in two types, namely a simple plastic box (composed of a single piece) and a foldable plastic box (composed of multiple pieces). There is not much difference in the price between the two, however, the foldable plastic box is more convenient and suitable for storage and is widely used.

4.3.1.2 Materials for plastic returnable boxes

Most plastic returnable boxes are made of polypropylene (PP), not polyethylene (PE). In general, the use of polyethylene is limited to items for cold climates or applications specific to refrigerator cars. Other kinds of plastic boxes made of polycarbonate or ABS are also seen on the market, but those actually implemented to the fields are very few. This Technical Report addresses polypropylene-made RTIs.

4.3.2 Plastic returnable corrugated boxes

Similar to a paper-based returnable cardboard box, the hollow structure is adopted for a plastic-based corrugated container for keeping and carrying parts and components in the production of vehicles and electronic home appliances. Due to its outstanding characteristics, such as durability against shock and a high level of hygiene, the plastic box is regarded as ideal for keeping and carrying highly sensitive parts. This plastic box is also replacing wooden crates.

4.3.2.1 Applications for returnable plastic corrugated boxes

The largest application for plastic returnable corrugated boxes is for industrial use, followed by public engineering and building works. Most of these RTIs are used as returnable boxes for keeping and carrying parts and components used in a broad range of products related to liquid crystal display TVs and automobiles.

4.3.2.2 Materials for returnable plastic corrugated boxes

The type of resin used for plastic corrugated returnable boxes is mostly polypropylene. The use of polyethylene is mainly limited to the items used in cold climates or applications specific to refrigerator cars.

Table 2 — Typical applications of plastic corrugated boxes

Application	Examples
Packing materials	Returnable boxes, partition boards/cushions, shock absolvers
Public engineering and building materials	Protection sheets, partitions, heat insulating material supporters
Agriculture and fishery	Fishery products, agricultural product container cases
Others	Office equipment/supplies, interior materials for automobile, slip sheets

4.4 Partitions

Some pallets and returnable boxes are equipped with shock absorber-type materials to protect them from shock or vibration in the transportation flow. An effective solution is the use of partitions or sorting boards to separate the contents, making it possible to place many items on a single pallet or in a returnable box. This is defined as a "partition" in this technical report. A typical example in this report would be a post-type partition used with the post pallet as illustrated below in Figure 12. This group also includes packing material used to protect or arrange the contents between the posts or for dividing the contents into several smaller sections as illustrated in Figures 13 and 14.

4.4.1 Posts

Figure 12 shows a post normally used to securely fix the packing material or returnable box onto the post pallet. These posts are generally made of plastic or metal, but this report covers only plastic-made posts.

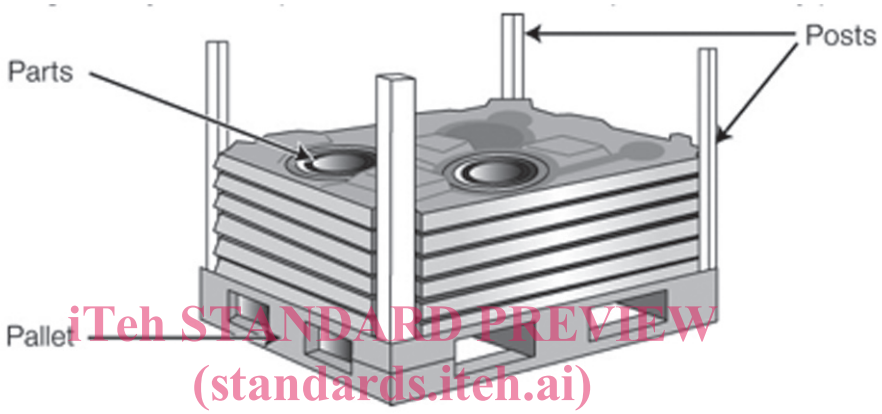

Figure 12 — Post

4.4.2 Packing materials

Packing materials should be provided to protect the items from shock or vibration that may be encountered during transportation. They are also used to protect the product from being touched or hit by the pallet or returnable box in which they are placed. This report applies to packing materials made of high resilient flexible substances like plastic, urethane, and polystyrene foam. (See Figures 13 and 14.)

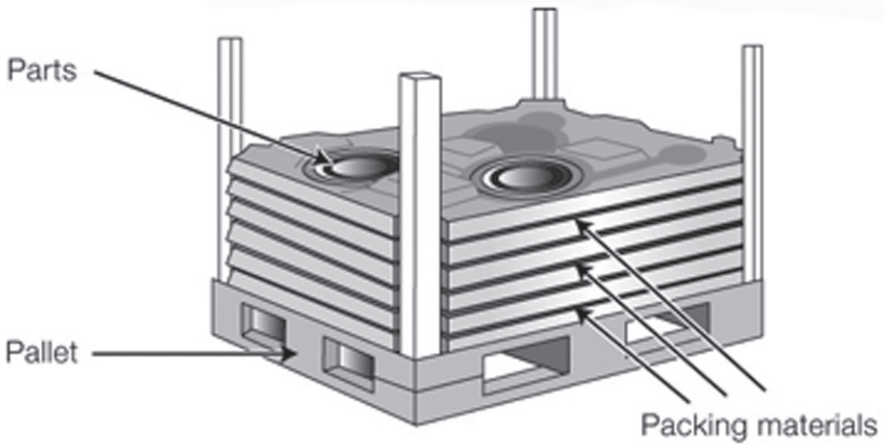

Figure 13 — Packing material

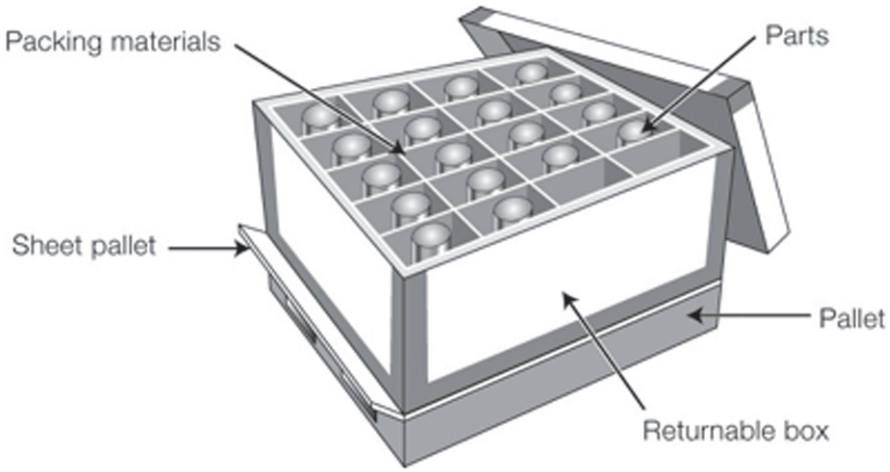

Figure 14 — Packing material

5 Unique Identifier of Returnable Transport Items (RTIs)

5.1 Data field identification

For the identification of returnable transport items, the Data Identifier "25B" defined in ISO/IEC 15459-5 should be used. See the data structure in Table 3.

5.2 Maximum data length

RTI identification data should contain a maximum of 35 characters, not including the Data Identifier. With the express agreement of the trading partners, this length may be extend up to, but shall not exceed 50 characters (exclusive of the Data Identifier). This specification of data length supports the language that appears in ISO/IEC 15459-5.

5.3 Character set

The character set defined in ISO/IEC 646 is recommended.

5.4 Data structure

Table 1 shows an example of the RTI Unique Item Identifier (UII) data structure. A description of the GS1 data structure is found in ISO/IEC 15459-5.

Table 3 — Data structure

25B	IAC	CIN	SN

5.4.1 Issuing Agency Code (IAC)

The Issuing Agency Code (IAC), which consists of a maximum of three (3) characters, is used to identify the entity/organization/company authorized by the appropriate registration authority as an issuing agency in accordance with ISO/IEC 15459-2. This includes, for example, UN (Dun and Bradstreet), OD (Odette Europe) and LA (JIPDEC/CII).

5.4.2 Company Identification Number (CIN)

The Company Identification Number (CIN) is a unique code assigned by the issuing agency to individual companies. Each issuing agency has its own format for the CIN. Depending upon the specific issuing agency employed the CIN may be followed by a Factory Identification Code (FIC), Kind Code (KC), and Partition Code (PC) as described in ISO Technical Report 17370.

5.4.3 Serial Number (SN)

When the Serial Number (SN) is combined with IAC and CIN, the combination constitutes a globally unique identifier for the RTI. Once created and attached to an RTI, the combination of CIN and SN shall be fixed and unchangeable for that specific RTI throughout its lifetime. The Serial Number (SN) may be composed of numeric or alphabetic characters or a combination. The structure is illustrated in Annex A.

5.4.4 Structured data

In transportation, items in a returnable box are usually protected with packing materials. When emptied, the returnable box should be returned, along with the packing materials. This implies the importance of unique identification data in a structured format on the returnable boxes and the packing materials. The data format defined in Annex B illustrates the relation between the returnable box and the associated packing materials.

6 Marking method

6.1 Label

Since each RTI has its own globally unique number as shown in Table 3, creating unique labels for individual items is critical. However, the process of creating individual labels is more costly than creating a large number of identical labels. In addition, most labels are accompanied by the risk of peeling off during a long cycle of reuse and must be able to withstand cleaning from time to time. But using highly durable labels comes with a higher cost.

6.2 Direct marking

6.2.1 Definitions

Direct marking is a technique categorized as an Automatic Identification and Data Capture (AIDC) technology, in which a mark is placed directly on the product (item, part/component and its package) without using labels or nameplates. Direct marking can also refer to the symbol itself that is marked using this technique.

6.2.2 Marked symbols

Several symbols can be used for identification purposes, including OCR (Optical Character Recognition), linear and two-dimensional symbol. However, only matrix-based 2D symbols are included in this technical report.

6.2.3 Considerations

A wide range of products and materials are marked using a variety of direct marking methods, making the development of a universal standard on the quality of marking more complicated than one for printing a symbol on paper-based media. However, if companies make use of only proprietary standards, worldwide standardization of direct marking beyond the framework of individual companies and industries will be difficult and this may adversely affect the widespread use of direct marking

