SLOVENSKI STANDARD
SIST EN 9132:2009

01-september-2009

Aeronavtika - Sistem vodenja kakovosti - Zahteve za kakovost ļ rtne kode Data Matrix za oznaļ evanje delov

Aerospace series - Quality management systems - Data Matrix Quality Requirements for Parts Marking

Luft- und Raumfahrt - Qualitätsmanagementsystem - Data Matrix Qualitätsanforderungen für Teilemarkierung

Série aérospatiale - Systèmes de management de la qualité - Exigences qualité du marquage des pièces en code-barres Data Matrix

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ICS:

03.120.10	Vodenje in zagotavljanje kakovosti	Quality management and quality assurance
49.020	Letala in vesoljska vozila na splošno	Aircraft and space vehicles in general

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English Version

Aerospace series - Quality management systems - Data Matrix Quality Requirements for Parts Marking

Série aérospatiale - Systèmes de management de la qualité - Exigences qualité du marquage des pièces en code-barres Data Matrix

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard (EN 9132:2006) has been prepared by the European Association of Aerospace Manufacturers - Standardization (AECMA-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of AECMA, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2006, and conflicting national standards shall be withdrawn at the latest by October 2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Introduction

1.1 Scope

This standard defines uniform Quality and Technical requirements relative to metallic parts marking performed in using "Data Matrix symbology" used within the aerospace industry. The ISO/IEC 16022 specifies general requirements (data character encodation, error correction rules, decoding algorithm, etc.). In addition to ISO/IEC 16022 specification, part identification with such symbology is subject to the following requirements to ensure electronic reading of the symbol.

The marking processes covered by this standard are as follows:

— Dot peening

— Laser

— Electro-chemical etching

Further marking processes will be included if required.

This standard does not specify information to be encoded

Unless specified otherwise in the contractual business relationship, the company responsible for the design of the part shall determine the location of the Data Matrix Marking. Symbol position should allow optimum illumination from all sides for readability.

1.2 Convention

The following conventions are used in this standard:

— The words “shall” and “must” indicate mandatory requirements.

— The word “should” indicates requirements with some flexibility allowed in compliance methodology. Producers choosing other approaches to satisfy a “should” must be able to show that their approach meets the intent of the requirement of this standard.

— The words “typical”, “example”, “for reference” or “e.g.” indicate suggestions given for guidance only.

— Appendices to this document are for information only and are provided for use as guidelines.

— Dimensions used in this document are as follows. Metric millimetre sizes followed by Inches in brackets unless otherwise stated.

2 Normative references

The following referenced documents are indispensable for the application 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/IEC 16022, *Information Technology — International Symbology Specification — Data Matrix.*

EN 9102, *Aerospace series — Quality Systems — First article inspection.*

3 Marking requirements

3.1 General requirements

— Rows and columns:

Rows and columns connected with Data Matrix symbology shall conform to ECC200 in the ISO/IEC 16022

— Square versus rectangle:

Matrix may be square or rectangular within ECC200 requirements.
Square is preferred for easier reading.

— Quiet zone:

The quiet zone (margin) around the matrix shall be equal to or greater than one (1) module size.

— Round surface:

If the marking is made on round/curved surface, the symbol coverage shall be equal to or less than 16 % of the diameter (or 5 % of circumference).

— Symbol size:

To facilitate electronic reading of symbol, the overall symbol size should be less than one 25,4 mm (1.000 inch), outside dimension, longest side. Irrespective of matrix size used, the requirements included in this standard shall be applied.

— Angular distortion of the symbol:

Angular deviation of 90-degree axes between row and column shall not exceed ± 7 degrees (see Figure 1 below).

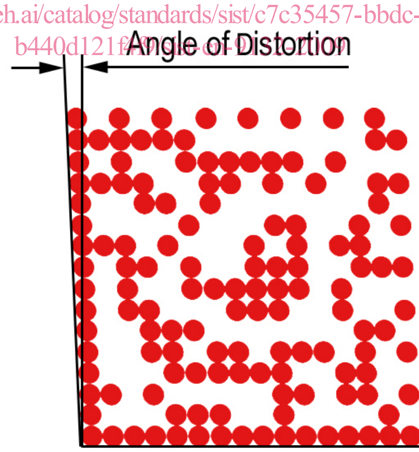


Figure 1 — Angle of distortion

3.2 Dot peening

3.2.1 Description of process

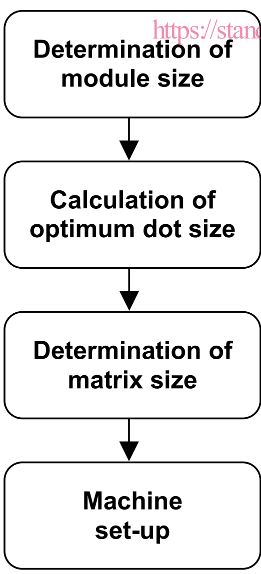
Dot-peen marking technology typically produces round indentations on a part's surface with a pneumatically or electromechanically driven pin, otherwise known as a stylus. Critical to the readability of dot-peen marked symbols are the indented dot's shape, size, and spacing. The dot size and appearance are determined mostly by the stylus cone angle, marking force, and material hardness. The indented dot created should be suitable to trap or reflect light and large enough to be distinguishable from the parts surface roughness. It should also have spacing wide enough to accommodate varying module sizes, placement, and illumination.

The issues involved in marking and reading dot-peen-marked symbols on metals are different than symbols printed on paper. The first fundamental difference is that the contrast between dark and light fields is created by artificial illumination of the symbol. Therefore, the module's shape, size, spacing, and part surface finish can all affect symbol readability.

The key to a successful dot-peen marking and reading project is to control the variables affecting the consistency of the process. Symbol reading verification systems can provide feedback of the process parameters to some extent. Marking system operating and maintenance procedures must be established to help ensure consistent symbol quality. Regular maintenance schedules should be established to check for issues such as stylus wear.

Additional processes, like machining dedicated surfaces, may be necessary to improve the symbol readability. Cleaning the part surfaces prior to marking with an abrasive pad to remove coatings, rust, and discoloration, or using an air knife to blow away excess machining fluids, debris, or oil can also increase the symbol readability.

3.2.2 Instructions for determination of marking parameters



Determine minimum module size according to the surface texture. See Table 1, Figure 2 (inch) or Figure 3 (mm).

Calculate dot size with regard to the above minimum module size in choosing stylus angle (60°, 90° or 120°) depending on maximum depth allowed by Engineering Design requirements. See Table 2 for the optimum dot size.

Determine matrix size depending on the information coded in the matrix. (Reference tables in Annex A for minimum matrix size based on available marking area).

Set up machine (e.g. in height, air pressure, force, etc.) for desired dot geometry.

3.2.3 Requirements

— Data Matrix Symbol Nominal Module Size:

The surface texture of the part affects the quality of a Data Matrix symbol produced by dot peening. Table 1 and Figures 2 and 3 show the minimum readable module size requirements to the surface texture of the part. The Engineering Design authority shall approve changes to the minimum module size.

Table 1 — Minimum readable module size by surface texture (Ra)

Surface Texture (Ra)		Minimum module size	
Microinches	Micrometres	Inches	Millimetres
32	0,8	0.0075	0,19
63	1,6	0.0087	0,22
95	2,4	0.0122	0,31
125	3,2	0.0161	0,41
250	6,3	0.0236	0,60

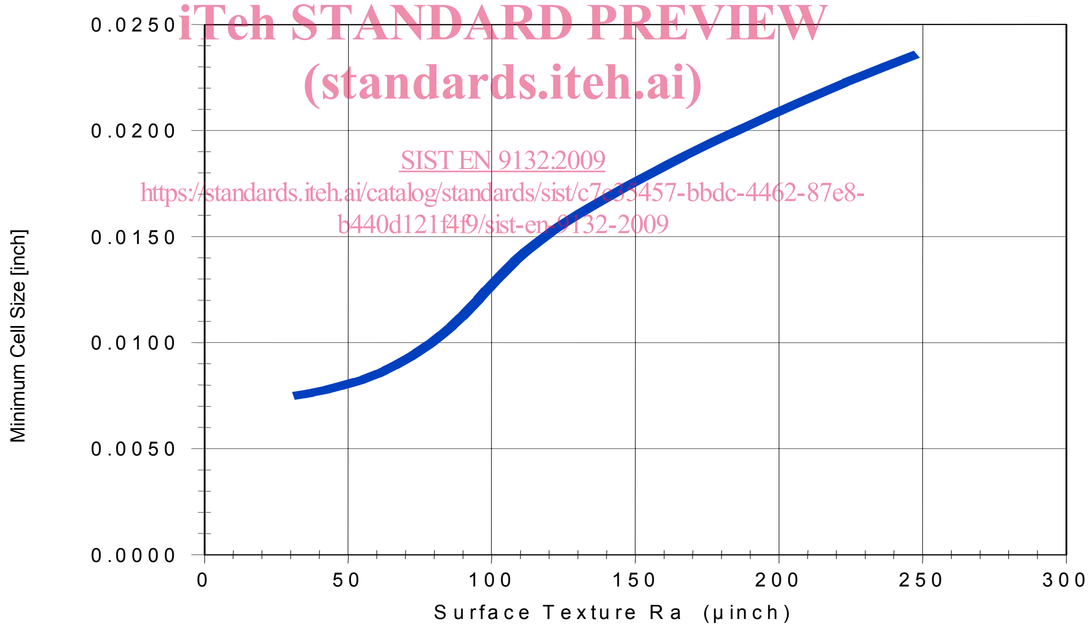


Figure 2 — Minimum module size (inch) by surface texture (µinch)

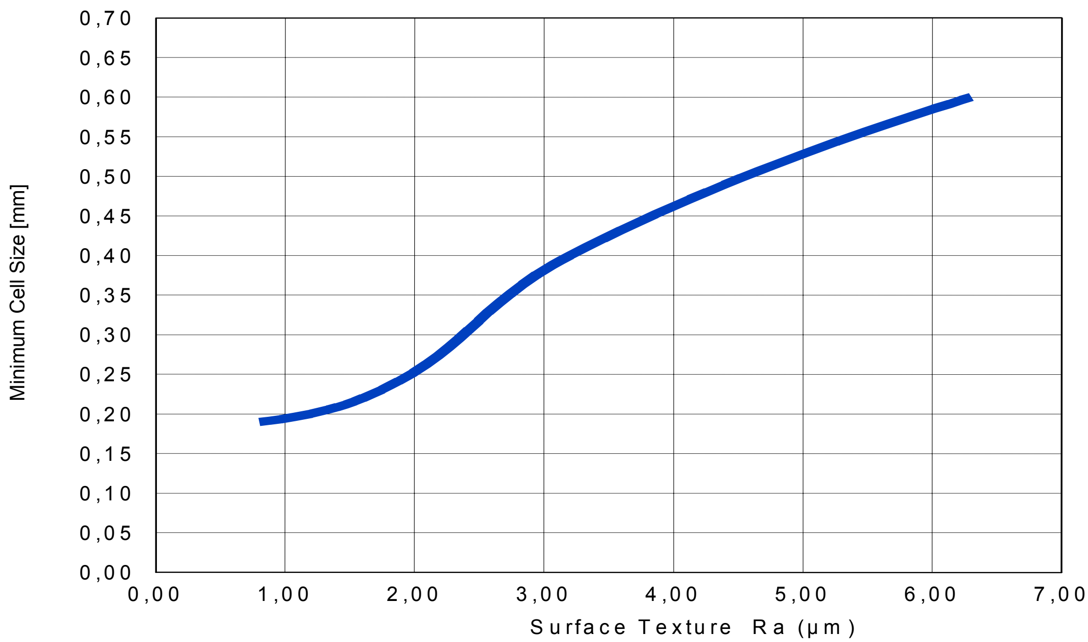


Figure 3 — Minimum module size (mm) by surface texture (µm)

— Data capacity:

For information, tables in Annex A for Dot Peening show the symbol size and the data capacity compared to the nominal module size and the number of rows and columns relative to surface texture. These tables are based on practical testing.

— Data Matrix symbol quality requirements:

Below are the symbol quality requirements of the Data Matrix and marking equipment but these may vary according to the design requirements and responsibility.

Dot depth is subject to Engineering Design requirements. The Dot depth is based upon the requirements for process, environment survivability and other material considerations.

Stylus radius is also an Engineering Design requirement. The maximum tolerance shall not exceed 10 % of the Stylus radius.

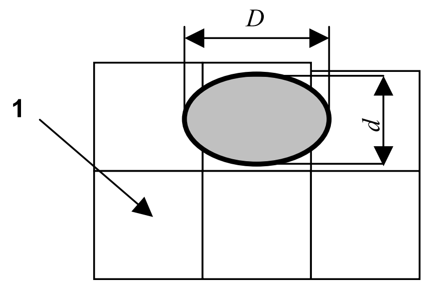
Surface colour and colour consistency may be specified as an Engineering Design requirement. In order to maximize readability, variation in surface colour should be minimized.

Stylus cone angle (Ref α in Annex B) is an Engineering Design requirement. The cone angles permitted are 60°, 90° and 120°. The tolerance on the cone angle shall be ± 2°. For general quality of mark and stylus life, stylus cone angle of 120° is preferred.

Stylus point finish shall be polished. Surface texture shall not exceed 32 µinch or 0,8 µm. Guidance instructions for grinding are given in Annex B.

Stylus point concentricity should be 0,04 mm (0.0016") total indicator reading, or 0,02 mm (0.0008") radial point displacement. Point concentricity is referenced to stylus centerline. Hand held grinding of stylus points is not permitted.

Dot size shall not exceed 105 % of the nominal module size and shall not be less than 60 % of the nominal module size. The ovality (see Figure 4 below) of the dot shall not exceed 20 % of the module size. No more than 2 % of the total number of modules may contain dots that are outside of these ranges. The minimum dot size shall not be less than 0,132 mm (0.0054") unless approved by Engineering Design authority.



Key

1 Module

$D - d \leq$ **20 % of the module size**

Figure 4 — Definition of ovality

Table 2 gives limits for dot size and dot centre offset useable whatever the nominal module size.

Table 2 — Limits for dot size and dot centre offset

Characteristic	Requirement
Stylus angle	120°, 90°, 60°
Stylus point radius	Subject to engineering design requirements
Dot size (% of the nominal module size)	60 % to 105 %
Dot centre offset (% of the nominal module size)	0 % to 20 %
Angle of distortion	± 7°

Figures 5 and 6 show definition of nominal module size, dot centre offset and dot size.

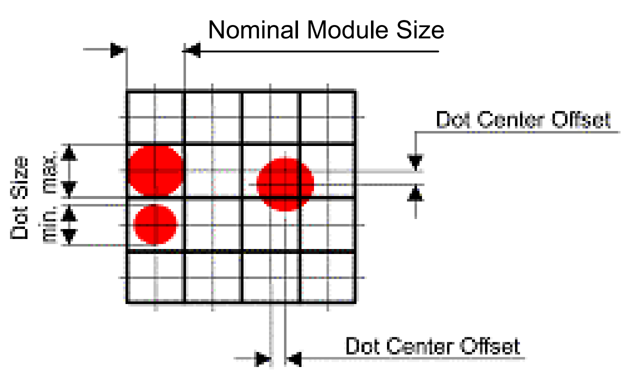


Figure 5 — Definition of nominal module size, dot size and dot centre offset

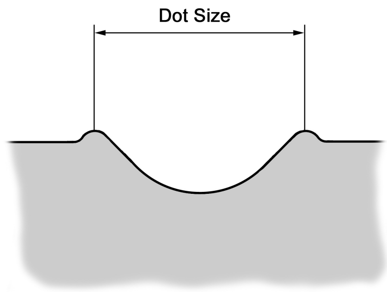


Figure 6 — Detail definition of dot size

Annex C (Table C.1 in inches and Table C.2 in millimetres) contains examples of required tolerances in comparison to the nominal module sizes.

— Data Matrix symbology marking on coloured or coated surfaces:

When marking is located on a coloured or coated surface, the marking parameters should be validated in an actual production line environment on production or representative parts. The marking process must demonstrate all requirements contained herein, and shall be verified and validated as per Clauses 4 and 5.

— Data Matrix symbology marking on surfaces which are subject to further surface treatments by abrasive methods:

Surface treatments like shot peening and spindle deburr can affect the quality of a Data Matrix symbol. Therefore the marking parameters should be validated in an actual production line environment on production parts post-surface treatment. The marking process must demonstrate all requirements contained herein, and shall be verified and validated as per Clauses 4 and 5.

3.3 Laser

3.3.1 Description of process

Laser marking

Laser marking is a process, which uses the thermal energy of the laser beam to vaporize, melt / bond or change the condition of the surface.

Due to the interaction of the laser beam with the material surface, laser marking must not be used in the following circumstances unless specifically approved by Engineering Design authority:

a) Classified [1)] components

b) Titanium alloys

NOTE 1 Any deviation from the above list requires Engineering Design Authority.

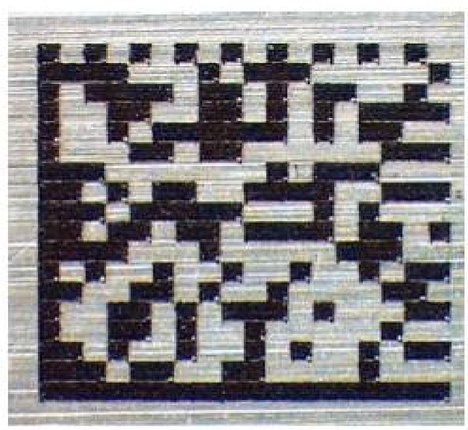


Figure 7

1) Parts classification is the responsibility of the Engineering Design Authority and will be determined by results of an appropriate failure annalysis. Parts classification refers to the component type, the failure of which will seriously hamper operation. Parts classification will be instructed by component definition.