



# SLOVENSKI STANDARD

## SIST EN 100012:2002

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### Basic specification: X-ray inspection of electronic components

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Grundspezifikation: Röntgenprüfung von Bauelementen der Elektronik

Spécification de base: Contrôle aux rayons X des composants électroniques

Ta slovenski standard je istoveten z: **EN 100012:1995**

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### **ICS:**

31.020	Elektronske komponente na splošno	Electronic components in general
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# CENELEC

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

**Foreword**

This European Standard was prepared by CECC WG-DE.

The text of the draft based on document CECC(Secretariat)3346 was submitted to the formal vote; together with the voting report, circulated as document CECC(Secretariat)3554, it was approved as EN 100012 on 1994-06-06.

This European Standard supersedes CECC 00 012:1985.

The following dates were fixed:

- latest date by which the EN has to be implemented  
at national level by publication of an identical  
national standard or by endorsement (dop) 1995-07-06
- latest date by which national standards  
conflicting with the EN have to be withdrawn (dow) 1996-03-06

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## 1 Definitions

### 1.1 Radiography

Radiographic inspection procedure which uses X-ray films for visual examination.

### 1.2 Radioscopy

X-ray inspection procedure which uses an X-ray image intensifier, a diode array or an X-ray sensitive TV-camera as the image detector.

### 1.3 Searchray Camera

X-ray sensitive TV-camera.

## 2 Scope

This specification describes the equipment and procedures to be used for the inspection of electronic components by means of radiography and radioscopy. When the x-ray inspection is prescribed in a detail or component specification, specific accept/reject criteria should be prescribed either directly or by reference to an appropriate higher order specification (e.g. generic or Technology Approval Schedule - TAS).

These types of examination are not intended as an alternative to pre- and post assembly visual inspections.

For certain component types, the construction materials may effectively restrict X-ray inspection performance. This aspect should be considered during the design of the component, when the application of this test method is specified.

## 3 Equipment and materials

One of the following systems has to be used for the X-ray inspection:

- (1) X-ray system in conjunction with a film as specified in section 5.8.
- (2) X-ray system in conjunction with a searchray camera (X-ray sensitive TV camera).
- (3) X-ray system with a focal spot size of  $d < 0,4$  mm in conjunction with an image intensifier.

Radiographic or radioscopy methods with or without magnification have to be used for the X-ray inspection. Unless otherwise prescribed in the component specifications, the resolution shall be 25  $\mu\text{m}$  or better in all angular directions. The spatial resolution shall be verified by means of indicators as specified in section 5.3 placed in the position of the component.

The contrast shall be verified by means of indicators as specified in section 5.4.

Where image enhancement techniques are used the spatial resolution and the contrast shall be verified without image enhancement.

The holding fixtures for holding the components shall comply with the specifications in section 5.2.

## 4 Procedure

### 4.1 General

The X-ray inspection shall be performed by the manufacturer inhouse or at an independent approved X-ray inspection facility in cooperation with the manufacturer.

The exposure factors, voltage (U in kV), current (I in mA), exposure time (t in min), focus-object distance (FOD in mm), focus-detector distance (FDD in mm) and the derivative geometric magnification factor  $M = FDD/FOD$  shall be adjusted as necessary to obtain the spatial resolution and contrast sensitivity prescribed for specific applications.

### 4.2 Mounting of components

Components shall be mounted in the holding fixture so that they are not damaged or contaminated. The fixtures shall not compromise or impede the interpretation of the X-ray inspection results.

### 4.3 Indicators for the spatial resolution

Unless otherwise prescribed in the applicable component specifications, the minimum spatial resolution of all X-ray inspection systems shall be 25  $\mu\text{m}$ . The spatial resolution shall be identified by means of a test array as presented for example in figure 1. Equivalent arrays for identifying the resolution may be used.

Such verification shall be performed at the beginning of all inspection to ascertain the basic ability of the used radiographic or radiosopic equipment to comply with the specified spatial resolution requirements. In the case of long-time operation, the spatial resolution shall additionally be tested and identified on a weekly basis to prevent and exclude ageing.

#### 4.4 Indicators for the image contrast

Indicators as specified in figure 2 shall be used for identifying contrast sensitivity.

Indicators shall be selected to give a radiographic density within  $\pm 10\%$  of the density of the area of interest of the component under inspection. The material and the height of the step(s) are prescribed in the object specific rules.

In conjunction with X-ray film techniques, this verification shall be required with each image. When 35 mm strip is used, the indicator shall be placed in a position normally occupied by a component for every 50 components or every 40 cm of film.

In conjunction with an image intensifier or a searchray camera, the performance of the inspection equipment in relation to contrast sensitivity shall be identified at the beginning of all radiosopic testing and shall additionally be verified on a weekly basis in the case of long-time operation.

This procedure shall equally be employed in the same manner for all testings and component examinations when digital image processing equipment is used to improve identification by means of image integration, contrast manipulation or digital filtering.

#### 4.5 Positioning of components

Components shall be radiographed in consecutive serial number order, when applicable. When a component is missing, the blank space shall contain either the serial number or an X-ray opaque object to assist in the accurate correlation of X-ray data.

Components shall be aligned in rows, starting with the lowest serial number in the top left corner, continuing to the right, then forming a second row from left to right, and so on. A clearance distance on the processed film of not less than 6 mm shall be provided between the components, between components and indicators and components or indicators and the edge of the film.

Such arrangement shall equally be employed when image intensifiers are used. When searchray cameras are used, components shall be inspected in consecutive order.

#### 4.6 Radiation direction

The directions of radiation are prescribed in the relevant object specific rules (e.g. Generic, Details or Component Specification or PAS).

Dynamic testing procedures shall preferably be selected for identifying surface defects (cracks). In conjunction with an image intensifier, optimum direction of radiosopic exposure for a specific defect shall be made adjustable by means of an object manipulator.

#### 4.7 Marking of documents

Documents are either the radiographic film or, in conjunction with the image intensifier and the searchray camera, a video tape or hardcopies, respectively.

The documents shall be identified such that the following information may be referenced to the inspection result:

- (1) Component manufacturer's name or code
- (2) Component type or part number
- (3) Production lot number or date code or inspection lot number
- (4) Number and date of the inspection
- (5) Component serial numbers or cross reference numbers, when applicable
- (6) Inspection facilities' identification (manufacturer or X-ray laboratory).

#### 4.8 Information concerning radiographic

To reduce scatter radiation the back of the film shall be protected by means of a lead screening not thinner than 1.6 mm. The X-ray beam shall be collimated by means of a lead diaphragm on the X-ray tube side to the size of the film.

The exposure time shall be adjusted so that the density of the film is between 1.5 and 2.

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The use of intensifier films shall not be permitted.

Films shall be developed in a process recommended by the film manufacturer. Each film shall be treated carefully so as to avoid processing defects such as finger prints, scratches, blurs, chemical residues, physical damages and so on.

#### 4.9 Information concerning radioscopy

The radioscopic inspection shall be performed by means of a TV monitor in a dark room. Inspection personnel shall be given not less than 5 minutes to let the eyes adapt.

#### 4.10 Operating personnel

Personnel who will perform the X-ray inspection shall be properly trained so that defects revealed by this method can be validly interpreted and compared with applicable reference specimens. All applicable national X-ray safety prescriptions shall be complied with.

### 5 Interpretation of results

Utilizing the testing systems specified herein, the radiographic or radioscopic results shall be inspected by the manufacturer to determine that each component conforms to the applicable reference specimens and the relevant criteria. Defective components shall be rejected.

### 6 Reports and records

#### 6.1 Reports of inspection

When specified in the appropriate CECC Specification the manufacturer shall furnish inspection reports with each component delivery lot. The report shall describe the results of the X-ray inspection and list the

- (1) Purchase order number, or equivalent identification
- (2) Component type or part number
- (3) Date code
- (4) Quantity inspected, with serial numbers when applicable
- (5) Quantity rejected, with serial numbers when applicable
- (6) Date of the inspection
- (7) Inspecting person's name

For each rejected component the cause for rejection shall be listed.

#### 6.2 Presentation of radiographs

When specified in the appropriate CECC Specification the manufacturer shall furnish the inspection records (radiographic films or video tape) relevant to a component delivery lot.

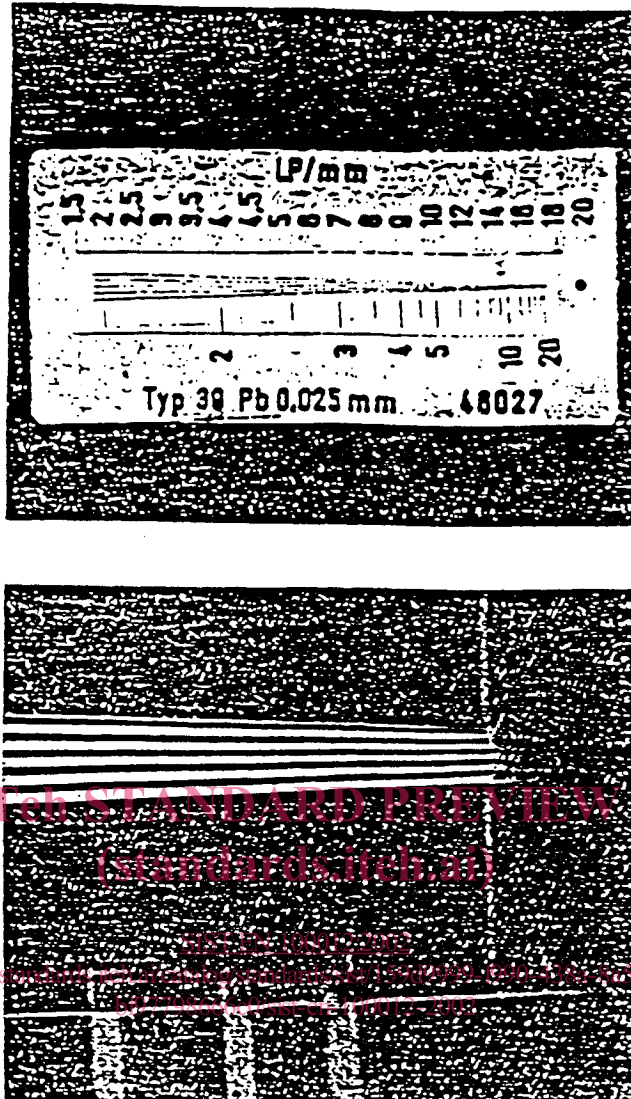
#### 6.3 Retention of reports and inspection records

The manufacturer shall retain one set of the inspection result and a copy of the inspection report relevant to a component delivery lot for a minimum period of three years.

### 7 Examination and acceptance criteria

The detailed examination and inspection requirements for a component and the accept/reject criteria shall be as specified in the relevant CECC specifications.





**Fig. 1: Example of a line test array for identifying spatial resolution**

top: general view of the line array. The array's resolution is between 1.5 and 20 line pairs per mm and the line width 333 up to 25  $\mu\text{m}$ , respectively.

bottom: radioscopic view of the peak of the penetrometer (taken by means of a microfocus equipment and an image intensifier).