

Förderverein für Elektrotechnische Normung (FEN) e. V.  
Cenelec Electronic Components Committee

# CECC

Système Harmonisé d'Assurance de la Qualité  
des Composants Electroniques

SPECIFICATION DE BASE:

## CONTROLE AUX RAYONS X DES COMPOSANTS ELECTRONIQUES

Harmonized System of Quality Assessment for  
Electronic Components

BASIC SPECIFICATION:

## RADIOGRAPHIC INSPECTION OF ELECTRONIC COMPONENTS

Harmonisiertes Gütebestätigungssystem für  
Bauelemente der Elektronik

GRUNDSPEZIFIKATION:

## RÖNTGENDURCHLEUCHTUNG VON BAUELEMENTEN DER ELEKTRONIK



# 1

Edition  
Issue  
Ausgabe

## CECC 00012

1985

CONTENTS

|                                          | Page |
|------------------------------------------|------|
| FOREWORD                                 | 2    |
| PREFACE                                  | 2    |
| 1 SCOPE                                  | 3    |
| 2 EQUIPMENT AND MATERIALS                | 3    |
| 3 PROCEDURE                              | 3    |
| 3.1 General                              | 3    |
| 3.2 Mounting                             | 4    |
| 3.3 Image Quality Indicators             | 4    |
| 3.4 Positioning of components            | 5    |
| 3.5 Views                                | 5    |
| 3.6 Film and Marking                     | 5    |
| 3.7 Non-film techniques                  | 5    |
| 3.8 Tests                                | 5    |
| 3.9 Processing                           | 6    |
| 3.10 Operating personnel                 | 6    |
| 4 INTERPRETATION OF RADIOGRAPHS          | 6    |
| 5 REPORTS AND RECORDS                    | 6    |
| 5.1 Reports of inspection                | 6    |
| 5.2 Radiographs                          | 7    |
| 5.3 Retention of Report and Radiographs  | 7    |
| 6 EXAMINATION AND ACCEPTANCE CRITERIA    | 7    |
| FIGURE 1 IMAGE QUALITY INDICATOR         | 8    |
| TABLE 1 TYPES OF IMAGE QUALITY INDICATOR | 9    |

FOREWORD

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby accepted by all member countries without further testing.

This specification has been formally approved by the CECC, and has been prepared for those countries taking part in the System who wish to invoke in their national harmonized specifications the use of RADIOGRAPHIC INSPECTION OF ELECTRONIC COMPONENTS. It should be read in conjunction with the current regulations for the CECC System.

At the date of printing of this specification, the member countries of the CECC are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom, and copies of it can be obtained from the addresses shown on the blue fly-sheet.

PREFACE

This basic specification was prepared under the aegis of the ECCOG and after consultation with Chairmen of CECC Working Groups 3, 4, 5, 9, and 21.

The text of this specification was circulated to the CECC for voting in the document indicated below and was approved by the President of the CECC for publication as a CECC Specification.

| <u>Document</u>       | <u>Date of Voting</u> | <u>Report on the Voting</u> |
|-----------------------|-----------------------|-----------------------------|
| CECC(Secretariat)1440 | October 1983          | CECC(Secretariat)1537       |

## 1 SCOPE

This specification describes the equipment and procedures to be used for the inspection of electronic components by radiographic means (X-ray). When radiographic inspection is prescribed in a detail specification, it shall be used in conjunction with the relevant Appendix of the appropriate CECC Generic Specification, wherein the specific accept/reject criteria will be prescribed. This specification does not apply to monolithic integrated circuits.

NOTE 1: This type of examination is not intended as an alternative to pre and post assembly visual examination.

NOTE 2: For certain component types, the opacity of the construction materials may effectively prevent radiographic identification of certain types of defects or materials from some or all possible viewing angles. This factor should be considered in relation to the design of the component when the application of this test method is specified.

## 2 EQUIPMENT AND MATERIALS

Unless specified in sub-clause 3.7, the equipment and materials for this test shall include:

- (1) Radiographic equipment with a sufficient energy level to penetrate the component. The equipment parameters (for example focal spot, film-focus distance, object-film distance, and so on) shall be such as to maintain a sharply defined image of a metal object with a major dimension of 0,0254 mm
- (2) Radiographic film - Very fine grain industrial X-ray film, either single or double emulsion
- (3) Radiographic viewer - Capable of 0,0254 mm resolution in major dimension
- (4) Holding fixtures - Capable of holding component in the required position without interfering with the accuracy or ease of image interpretation of all specified defects; or damaging component
- (5) Film holder - A 1,6 mm minimum lead topped table or lead backed film holder to prevent back scatter of radiation
- (6) Image quality indicator - Suitable image quality indicators to be used as quality references for the radiographs.

## 3 PROCEDURE

## 3.1 General

The radiographic exposure process shall be performed by the manufacturer in-house or at an independent approved radiography facility in conjunction with the manufacturer.

The X-ray exposure factors, voltage, milliamperage setting and time settings shall be selected or adjusted as necessary to obtain satisfactory exposures and achieve maximum image details of defect features within the sensibility limitations of the component.

The X-ray voltage shall be the lowest consistent with these requirements but shall in no case exceed 150 kV.

### 3.2 Mounting

Components shall be mounted in the holding fixture so that they are not damaged or contaminated and are in the proper plane as specified. The components may be mounted in any type of fixture, and masking with lead diaphragms or barium clay may be used to isolate multiple specimens. The fixtures or masking materials shall not block the view from the X-ray source to the film of any portion of the body of the component.

### 3.3 Image quality indicators

As quality references, image quality indicators shall be employed in all radiographic testing. A suitable range of indicators is shown in Figure 1 and Table 1. Equivalent indicators, to give an image of similar quality, may be used when approved by the ONS.

The use of such indicators and the indicator image shall meet the following requirements:

- (1) Indicator wires shall be visible on each radiograph
- (2) 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
- (3) Indicators shall be placed in diagonal corners on the source side of the film. The plane of the indicator shall be normal to the radiation beam. When 35 mm strip is used, the indicator shall be placed in a position normally occupied by a component and an indicator image shall be made (exposed) for every 50 components or every 40 cm of film, whichever is more convenient.
- (4) Distortion of any indicator shall not exceed 10 %.
- (5) The spacing between wires of an indicator shall not be distorted by more than 10 %. The percentage of distortion as used in this specification is defined as follows:

$$\text{Percentage distortion} = \frac{S_0 - S_1}{S_0} \times 100 \quad \text{where,}$$

$S_0$  = actual wire spacing

$S_1$  = wire spacing as it appears on the X-ray film.

### 3.4 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 hand 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 outer perimeters of all components, components and image quality indicators and components or indicators and the edge of the film.

### 3.5 Views

The directions of radiographic exposure shall be as prescribed for the component in the relevant Appendix of the appropriate CECC Generic Specification.

### 3.6 Film and Marking

The radiographic film shall be in a film holder backed with a minimum of 1,6 mm lead, or the holder shall be placed on a lead topped table. The film shall be identified such that the following information may be referenced to the radiograph:

- (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) Radiographic film view number and date
- (5) Component serial numbers or cross reference numbers, when applicable
- (6) X-ray laboratory identification.

### 3.7 Non-film techniques

When specified, the use of non-film techniques is permitted if permanent records are not required. The equipment shall be capable of producing results of sufficiently high quality when compared with film techniques. All requirements of this specification shall be complied with, except those pertaining to the actual film.

### 3.8 Tests

The X-ray exposure factor shall be selected to achieve the satisfactory resolution of an object of 0,0254 mm in the major dimension, and a film density between 1 and 2 in the area of interest of the image.

Radiographs shall be made for each view specified.

### 3.9 Processing

The radiographic film manufacturer's recommended procedure shall be used to develop the exposed film and the film shall be processed so that it is free of processing defects such as fingerprints, scratches, fogging, chemical spots, blemishes, and so on.

### 3.10 Operating personnel

Personnel who will perform radiographic inspection shall be properly trained in radiographic procedures and techniques so that defects revealed by this method can be validly interpreted and compared with applicable reference specimens.

## 4 INTERPRETATION OF RADIOGRAPHS

Utilising the equipment specified herein, radiographs 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. Interpretation of the radiograph shall be made under low environmental light level conditions without glare on the radiograph viewing surface.

The radiographs shall be examined on a suitable illuminator with variable intensity or on a viewer suitable for radiographic inspection on projection type viewing equipment. The radiograph shall be viewed at a magnification between 6X and 25X. Viewing masks may be used when necessary.

## 5 REPORTS AND RECORDS

### 5.1 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 radiographic 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.

For each rejected component the type or part number, serial number when applicable, and cause for rejection shall be listed.

5.2 Radiographs

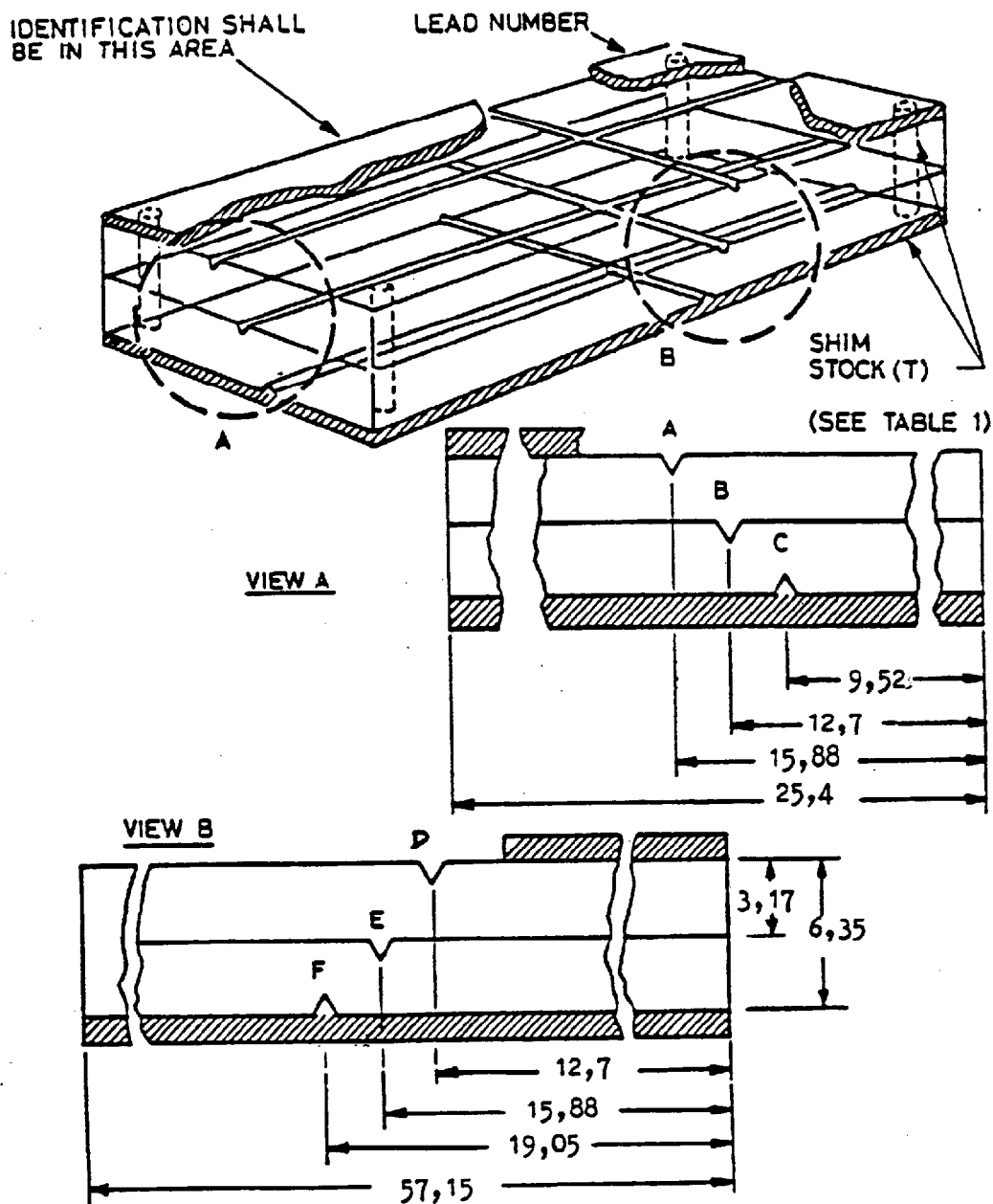
When specified in the appropriate CECC specification the manufacturer shall furnish duplicate radiographs, or photographic reproductions, of each radiograph relevant to a component delivery lot.

5.3 Retention of report and radiographs

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

6 EXAMINATION AND ACCEPTANCE CRITERIA

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



# NOTES :

- (1) ALL DIMENSIONS ARE IN MM
- (2) EXEPT FOR GROOVES AND WIRES, DIMENSIONAL TOLERANCES SHOULD BE  $\pm 0,127$  mm

FIG. 1 IMAGE QUALITY INDICATOR