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Cenelec Electronic Components Committee

CECC

Système Harmonisé d'Assurance de la Qualité
des Composants Electroniques

**GUIDE CECC SUR L'EMPLOI
DE LA METHODE PPM
EN ASSOCIATION
AVEC LE SYSTEME CECC**

Harmonized System of Quality Assessment for
Electronic Components

**CODE OF PRACTICE ON THE
USE OF THE PPM APPROACH
IN ASSOCIATION WITH
THE CECC SYSTEM**

Harmonisiertes Gütebestätigungssystem für
Bauelemente der Elektronik

**LEITFADEN ZUR VERWENDUNG
DES PPM-KONZEPTES
IM CECC SYSTEM**



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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.

At the date of printing of this publication, 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 "Code of Practice on the use of the ppm approach in association with the CECC System" was prepared by CECC Working Group "Assessment Techniques".

The text of this "Code of Practice" was circulated to the CECC for voting in the document indicated below and was ratified by the President of the CECC for printing:

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1 INTRODUCTION

The ppm approach provides the climate, opportunity, and procedures for extending quality improvement beyond "conformance to specification" into the field of "fitness for use" with the prime objective of decreasing progressively the level of component rejection occurring right through the equipment manufacturing process. This level is then measured in units of parts per million (or ppm) as a proportion of the total quantity delivered and used in the specified application.

A necessary starting point for any satisfactory application of the ppm approach is a good and technically-sound specification. The CECC System offers a structure of mutually-compatible specifications which are written in accordance with clearly-defined rules and which are very suitable for use with the ppm approach.

To employ the principle of the ppm approach between the manufacturer and the user of an electronic component in order to reach the agreed target, there is need for the establishment of close cooperation between the two parties. This requirement applies throughout the commercial, technical, manufacturing and quality areas of the companies concerned.

NOTE: Annex A contains definitions of the terminology used in this Code of Practice.

2 THE CECC SYSTEM'S RELATIONSHIP WITH AQL, APA AND PPM METHODS

The CECC System is based on the assessment of component quality in accordance with comprehensive, consistent and precise component detail specifications. The initial assessment is carried out by means of qualification or capability approval testing, and is followed by testing on a lot-by-lot and periodic basis. In order to sustain confidence in component quality without increasing testing costs to unreasonable levels, statistical sampling methods are applied, usually in association with defined Acceptable Quality Levels (AQLs). In practice, the actual level of quality is usually far better than the AQL.

In order to reflect the actual level of component quality, the CECC System has been augmented by a procedure for determining the Assessed Process Average (APA). This procedure, published as CECC 00 014, applies primarily to large scale production and enables the manufacturer to accumulate and analyse the results of inspection for non-operatives over a number of lots and, on the basis of the information obtained, to determine an APA figure for information to his customers.

The procedures associated with both AQL and APA methods are essentially component-based and provide information concerning the component's conformance to the relevant detail specification. These procedures do not relate directly to possible end uses of the component, as the equipment manufacturer, the final use and the operating environment of a component are frequently unknown to the component manufacturer.

The ppm approach, in contrast, is intended to optimise the performance of a specific component in a given environment. It has the purpose of minimising rejects and ensuring the component's conformance to usability requirements in the particular application for which it is employed by the equipment maker concerned. To achieve this aim, detailed verification and analysis of rejected components are required and it is essential that the component manufacturer and the component user maintain close liaison to permit an efficient and rapid response to the results of this analysis.

Because of the different basis of the ppm approach, there is no mathematical relationship with values of AQL or APA.

3 BASIC PRINCIPLES OF THE PPM APPROACH

A decision to adopt the ppm approach may be reached by the manufacturer and the user of a component as an extension of quality disciplines beyond the present scope of the CECC System, but not in conflict with its principles.

The principal characteristics of the ppm approach are:

- 3.1 Basic assumption: it is in the interest of both the component manufacturer and the component user to seek manufacture of the component and of the equipment approaching the level of "zero defects".
- 3.2 The objects are:
 - 3.2.1 to ensure that the manufacturer is producing the most suitable component for the user and that the user is employing that component appropriately
 - 3.2.2 to improve not only the quality of the component, but also the context in which it is used
 - 3.2.3 to provide a means of measuring the results achieved and comparing them with the target of "zero defects".
- 3.3 The requirements are:
 - 3.3.1 to ensure that both the manufacturer and the user of the component recognize commercial benefits which are derived from the use of the ppm approach
 - 3.3.2 to ensure close cooperation between the individual manufacturer and the individual user of the component, to develop mutual confidence
 - 3.3.3 to recognize that the ppm approach is always specific to individual component types and to their precise application
 - 3.3.4 to establish clear objectives with regard to defect levels and timescales
 - 3.3.5 to identify any component defect and, by cooperation, establish the mode of defect.

- 4 THE USE OF THE PPM APPROACH IN ASSOCIATION WITH THE CECC SYSTEM (see also Annex B)
- 4.1 During the equipment design stage, great care is required to ensure that the component is used within its specified conditions of use and in the optimum manner, taking account of the way in which the component will be assembled into the equipment.
- 4.2 It is necessary to match technical and economic requirements as closely as possible.
- 4.3 The requirements in 4.1 and 4.2 should be documented in the form of a CECC detail specification, containing limiting values, characteristics and tests with the associated acceptance limits.
- 4.4 The component in question should be submitted for qualification or capability approval in accordance with this detail specification, and the approval should be maintained for the duration of the component's use in the specified context.
- 4.5 A defect analysis programme shall be instituted for the purpose of identifying and rectifying the causes of defects. This defect analysis and rectification programme is illustrated in Annex C.
- 4.6 As a result of the actions taken under 4.3, 4.4 and 4.5, remedial actions may be required, individually or in combination:
- 4.6.1 amendment of the component detail specification, in order to correct errors which have been detected, to define some parameters more closely, to include characteristics which may have been omitted, or to vary the specified limiting values and guidance for the use of the component
- 4.6.2 modification of materials or of manufacturing or handling techniques
- 4.6.3 as a result of actions taken under 4.6.1 and 4.6.2, retesting or requalification of the component, as necessary
- 4.6.4 modification of the equipment's design, assembly or handling, to remove any unnecessary and undesirable stresses
- 4.6.5 in extreme cases, modification of field use conditions, where it is impossible to reduce the defect rate by other methods.
- 4.7 A ppm approach project may be given a target value for defect rate, the achievement of which signifies the successful completion of the project.
- 4.8 Where it becomes obvious that the target has not been reached but further progress cannot be achieved without disproportionate effort and expenditure, the manufacturer and the user of the component may declare the project complete. However, it should be kept under review and cooperation should continue.
- 4.9 The processes which are described above may result in a large number of sequential and/or parallel activities.

- 4.10 While it is recognized that the ppm approach is concerned with components in equipment design and manufacture, field failure data provide additional sources of valuable information affecting component use and selection.
- 4.11 A flowchart illustrating the use of the ppm approach is given in Annex B.

5 CONCLUSION

As indicated in 4.6, a number of courses of action are available for the reduction of excessive defect rates.

The need for defect analysis and subsequent remedial action can be - indeed, should be - reduced as much as possible before equipment assembly begins. The methods for achieving this are indicated in 4.1 to 4.4. Particular emphasis should be given to the potential benefits of the CECC System, which offers independent supervision of component conformance, standard quality assessment methods and the disciplines of a firmly-regulated structure of specifications. The CECC System provides a sound basis for the commencement of projects to minimise defect rates by means of the ppm approach.

It has been found that a side benefit of the ppm approach is a reduction of component failures, better component usage and therefore a lower failure rate of equipment in the field.

Terminology associated with the ppm approach

NOTE: In general terms, the definitions given in IEC 410: 'Sampling plans and procedures for inspection by attributes' are applicable to this Code of Practice. However, some terms require additional clarification, which is given in this Annex, and which explains their meaning in the context of this Code of Practice.

A1 Defect

Any function or characteristic of a component which may adversely affect the assembly, inspection, test and performance of an equipment.

A2 ppm defect rate

The number of defects relating to an individual component type employed for a single purpose in a specific piece of equipment, expressed as units of parts per million (or ppm), in relation to the total number used for this purpose. The theoretical target value is zero (but see 4.8 of this Code of Practice).

A3 The ppm approach, the APA procedure and the AQL method**A3.1 The ppm approach**

A method of operation, requiring close cooperation between the manufacturer and the user of an electronic component, which seeks to provide the climate, opportunity and procedures for extending quality improvement beyond "conformance to specification" into the field of "fitness for use", with the prime object of decreasing progressively the level of component rejection occurring right through the equipment manufacturing process. This level is then measured in units of parts per million (or ppm) as a proportion of the total quantity delivered and used in the specified application.

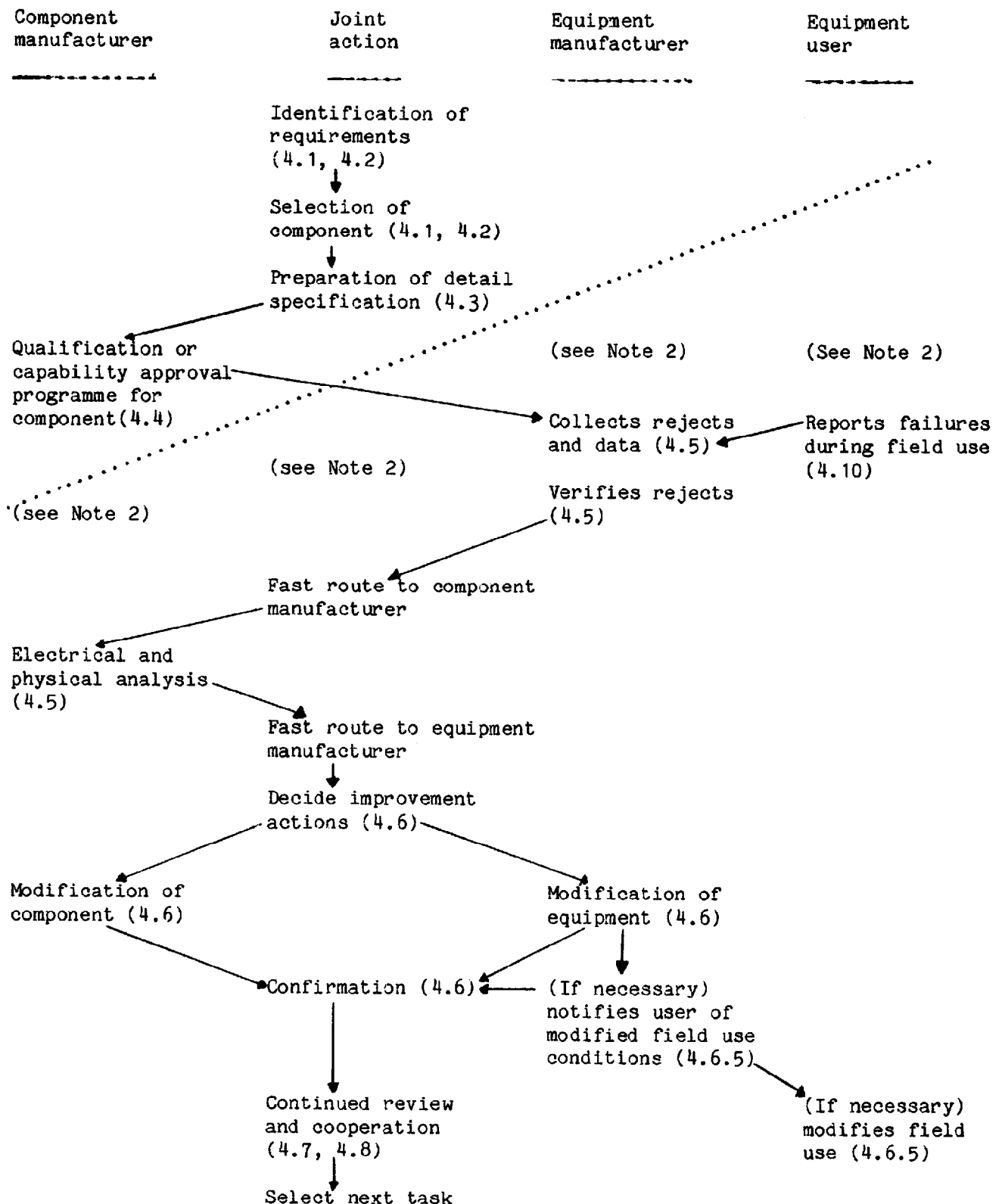
A3.2 The Assessed Process Average (APA) procedure

A procedure, described in CECC 00 014, which is intended to give information, within the limits of a given level of confidence, on the "assessed process average" of production, concerning non-operative components.

A3.3 Acceptable Quality Level (AQL)

The maximum percent defective (or the maximum number of defects per hundred units) that, for the purpose of sampling inspection, can be considered satisfactory as a process average.

The use of the ppm approach in association with the CECC System



NOTES: 1. Numbered references in parentheses are to actions described in the Code of Practice.

2. See Appendix C for detailed analysis of actions below the dotted line.