Process Assessment Schedule
for
Final Assembly of Electrical Connectors

Up-to-date lists and bibliographical references of other Process Assessment Schedules (PASs) may be obtained on application to the CECC General Secretariat or to any CENELEC member.

Further copies of this and other PASs may be obtained from:

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

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

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CECC 200 024 : 1997 iss1
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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 harmonised 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 recognised Mark, or Certificate of Conformity. The components produced under the system are acceptable in all member countries without further testing.

This specification 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 as listed in CECC 00 200.

PREFACE

This Process Assessment Schedule was prepared by Amphenol Ltd., Thanet Way, Whitstable, Kent CT5 3JF and Framatome Connectors UK Ltd., Connector House, Eyncourt Road, Woodside Estate, Dunstable, Beds LU5 4TS.

It is based wherever possible, on Publications of the International Electrotechnical Commission.
INTRODUCTION

The requirements for Process Approval of specialist contractors to the electronic components industry are given in CECC 00 114/V (RP14 Part V). The mechanism for approval defined in that RP requires the specialist contractor to have available an appropriate Process Assessment Schedule (PAS). This schedule defines how the principles and requirements of RP14 Part V are applied to a defined specialist process activity or service to be provided by the specialist contractor. PASs specify the production process and the associated quality factors which may reduce or eliminate the need for end of line testing. PASs also permit, as appropriate, the application of statistical process control techniques.

Due to the wide variation of connector housing styles, sizes, polarization and contact arrangements permissible within some connector detail specifications it is not practical for approved distributors to keep stock of every possible permutation. Therefore, this PAS enables distributors/specialist contractors to keep a stock of an approved manufacturers piece parts and carry out the final assembly, lot inspection and release to the customer.

The procedures agreed between the manufacturer and specialist contractor (distributor) shall establish means by which the approved manufacturer’s chief inspector shall be responsible for ensuring that the assembly of connectors at the specialist contractor will be carried out in conditions which would be applicable at his own premises.
SECTION 1: GENERAL REQUIREMENTS

1.1 SCOPE

This PAS specifies the terms, definitions, symbols, quality system, test, assessment and verification methods and other requirements relevant to the final assembly and supply of an approved electrical connector manufacturer’s piece parts and or sub assemblies at the premises of a CECC approved distributor in compliance with the general requirements of the CECC System for electronic components of assessed quality.

1.2 DEFINITIONS

1.2.1 Final assembly

The kitting of piece parts and/or sub-assemblies and undertaking the final processing to produce a complete connector as supplied to the customer.

1.2.2 Failure analysis

The logical, systematic examination of a failed item to identify and analyze the failure mechanism, the failure cause and the consequences of failure.

1.3 RELATED DOCUMENTS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CECC 00 114/V</td>
<td>Process Approval of specialist contractors within the electronic components industry</td>
</tr>
<tr>
<td>CECC 00 200</td>
<td>Register of Approvals</td>
</tr>
<tr>
<td>CECC 200 000</td>
<td>Requirements for Process Assessment Schedules for Process Approval</td>
</tr>
<tr>
<td>EN 175 100</td>
<td>Sectional specification: Two part and edge socket connectors for printed board applications</td>
</tr>
<tr>
<td>EN 175 200</td>
<td>Sectional specification: Circular connectors</td>
</tr>
<tr>
<td>EN 175 300</td>
<td>Sectional specification: Rectangular connectors for frequencies below 3 Mhz</td>
</tr>
<tr>
<td>IEC 68</td>
<td>Environmental testing</td>
</tr>
<tr>
<td>IEC 512</td>
<td>Electromechanical components for electronic equipment - Basic testing procedures and measuring methods</td>
</tr>
</tbody>
</table>
1.4 UNITS, SYMBOLS AND TERMINOLOGY

Units, geographical symbols, letter symbols and terminology shall, whenever possible, be taken from the following documents.

ISO 1000  SI units and recommendations for the use of their multiples and of certain other units
IEC 27   Letter symbols to be used in electrical technology
IEC 50   International electromechanical vocabulary
IEC 617   Graphical symbols for drawings
SECTION 2: QUALITY REQUIREMENTS OF THE PROCESS

2.1 PROCESS DESCRIPTION

The activity covered by this PAS is the final assembly of an approved connector manufacturer’s piece parts and or sub assemblies together with lot by lot inspection and release. The range of products that are covered by this specification are electrical low frequency connectors within the scope of Sectional Specifications EN 175 100, EN 175 200 and EN 175 300.

The final assembly process shall be carried out using identical piece parts supplied by the approved manufacturer and employing identical or equivalent procedures and equipment to the approved manufacturer. The tools, jigs and equipment necessary for the assembly operation and test equipment appropriate for quality conformance inspection shall be specified by the approved manufacturer in accordance with the terms of his approval.

The assembly process may include some or all of the following stages:-

- Generation of piece part/sub-assembly bills of material.
- Assembling insert to housing using techniques as defined by the manufacturer.
- Fitting polarization features.
- Inserting contacts.
- Assembly of coupling nut.
- Part marking/identification - including unique mark of specialist contractor.
- Inspect and test
  - Packaging - including marking requirements as required by the detail specification.

Inspection and release shall be carried out in accordance with the manufacturers procedures and the relevant detail specification.

The specialist contractor shall declare in the Process Manual the extent of the process, processes or services for which he is seeking approval, indicating how this falls within the scope of the referenced PAS.
2.2 QUALITY FACTORS

Quality Factors are those aspects of the process or service or contractors organization that significantly affect the quality and reliability of the service or component produced.

The specialist contractor shall define in his process manual the quality factors applicable to the process stages that are within their capability. The following are examples of Quality Factors which may apply to this specialist activity:-

Material quality (initial quality of consumables, piece parts and sub assemblies)
Process control (adhesive application)
Adhesive curing conditions
Process control (part identification/coding)
Ink curing conditions
Process control (assembly of nuts etc.)
Lot by lot testing
Dispatch

Each quality factor shall form the basis of a Process Specification which shall state how the specialist contractor monitors these quality factors. The quality factors may conveniently be combined with Process Specifications and Audit checklists in the form of a matrix as shown in Annex A.

2.3 PROCESS SPECIFICATIONS

Process Specifications are the means of defining and assessing the quality requirements of a specific process. Process Specifications and the associated quality factors are used to describe the minimum requirements for the control of that factor.

Due to the nature of the process it cannot realistically be defined in a General Process Specification, therefore, Custom Process Specifications shall be drafted by the specialist contractor based on Annex B. This Process Specification may be issued separately by the specialist contractor or included within the specialist contractor’s process manual.

2.4 PROCESS APPROVAL PROGRAMME

A formal approval programme in the traditional sense of manufacturing test vehicles and carrying out an initial approval programme is not required by specialist contractors to this PAS, as the performance of the connectors has been proven by the approved manufacturer’s approval programme. However, an initial audit must be undertaken by the approved manufacturer to ensure their processes and procedures have been employed correctly. If there is sufficient evidence of audits having been carried out on equivalent products this may be taken into consideration by the ONS. The specialist contractor shall undertake a pre-audit based on their Process Manual this shall then be independently audited by the ONS.
The assembly and lot by lot inspection shall be carried out in accordance with the approved manufacturers procedures and the relevant detail specification.

2.5 MAINTENANCE PROGRAMMES

For periodic tests, samples shall be taken from the specialist contractor’s production on the same basis as if they had been produced by the approved manufacturer and these samples shall be added to the specimens for test taken from the approved manufacturer’s own production. The number of samples taken from the specialist contractor shall be proportional to the quantities produced at the approved manufacturers site and his approved assembly distributors.

2.6 TEST METHODS

Testing shall be carried out in accordance with the requirements specified in the applicable Detail Specification (DS). The DS will refer to IEC 512 or IEC 68 test methods where available, if standard test methods are not available all details will be specified in the DS.

2.7 RELEASE TO CUSTOMER

Normal Quality Conformance Inspection requirements shall be as defined in the DS. A release for delivery is valid for 36 months unless otherwise specified in the DS. Connectors held for a period of 36 months or as defined in the DS shall be visually examined prior to delivery. The DS may specify additional re-testing e.g. solderability. Re-examination shall be performed using the original assessment levels. Once a lot has been satisfactorily re-inspected its quality is assessed for a further 36 months or as defined in the DS.

2.8 MODIFICATIONS TO APPROVAL

The specialist contractor covered by this PAS is only permitted to introduce modifications to the design, piece parts or processes that have been proven by the manufacturer and accepted by the ONS under the manufacturers required procedures for significant changes.
SECTION 3: SPECIALIST CONTRACTOR DOCUMENTATION REQUIREMENTS

3.1 PROCESS MANUAL

The primary document required by a specialist contractor to obtain process approval, is a process manual (RP 14 Part V, clause 2.5.1). A specialist contractor shall include in his process manual all topics included in this PAS. For simplicity it is suggested that the headings and sections of this PAS are mirrored in the specialist contractor’s process manual. Each clause in this PAS clearly indicates the requirements which the specialist contractor shall satisfy in order to comply with that clause. The process manual is the specialist contractor’s means of describing how he intends to satisfy these requirements.

3.2 PROCESS APPROVAL REPORTS

Following completion of approval activities, the specialist contractor shall prepare a report containing the following minimum requirements:-

- Statement of compliance to process approval programme
- The results of the initial internal audit including corrected deficiencies

The report shall be submitted to the ONS.

3.3 ABSTRACT OF DESCRIPTION OF PROCESS APPROVAL

The specialist contractor shall prepare an abstract for inclusion in CECC 00 200, Register of Firms, Products and Services Approved under the CECC System. This abstract is the specialist contractor’s prime means of advertising his service to CECC system users, and should thus usually take the form of a summary of the description of capability prepared as a sales statement.
SECTION 4: AUDITS

4.1 AUDIT PREPARATION PLANS

A key feature of Process Approval is the emphasis upon audit disciplines and audit check lists relevant to the requirements of the PAS and all quality factors. A specialist contractor shall undertake a programme of internal audits and a demonstration to the ONS of his preparedness for an external audit.

4.2 AUDIT CHECK LIST

The Process Manual shall include a comprehensive series of check lists to be used in internal and external audits. The check list will be a series of technical and quality prompts to be used by the specialist contractor undertaking internal audits or by the ONS undertaking approval audits. The purpose of the check list is primarily to ensure a consistent approach to auditing across a number of specialist contractors and ONSs.

4.3 INTERNAL AUDITS

The specialist contractor shall undertake an internal audit of his facility. This audit shall be of the same form as that to be undertaken by the ONS using the same plans and check list, the result of the internal audit including corrected deficiencies shall be submitted to the ONS.

The period of such audits shall not be greater than 12 monthly intervals.

4.4 EXTERNAL AUDITS

On the completion of the pre-audit the results together the completed statement of readiness will be submitted to ONS. Upon receipt of this information the ONS can assess the preparedness of the specialist contractor for an external audit.

ONS external audits will cover all aspects of the process approval over a fixed period not greater than 36 months.
SECTION 5: CORRECTIVE ACTIONS & FAILURE ANALYSIS

5.1 CORRECTIVE ACTIONS

Corrective actions are those actions undertaken by a specialist contractor to correct or remedy deviations from the stated requirements or non-compliances found during the audits.

The specialist contractor shall define his policy and procedure with respect to any permissible rework stages, rework is the rectification of processing errors prior to the release of the connector by means not differing from those used in the current process. Repair is the making good of an approved connector which has been damaged or become defective after release and is not permitted within the system.

5.2 FAILURE ANALYSIS

The specialist contractor shall define his policy and procedures with regard to the following aspects of failure analysis:-

Physical failure analysis, i.e. the reverse engineering of failed samples and/or recreation methods used to locate the physical failure mechanism. The extent, method and reporting of such analysis shall be stated. Physical failure analysis may need to be undertaken by the approved manufacturer but the summary of the investigation shall be given to the specialist contractor.
SECTION 6: CONTRACTOR TO CUSTOMER INTERFACE

The specialist contractor is permitted to release connectors only within the scope of his abstract and the scope of the approved manufacturer’s certificate for the relevant detail specification. Additional shell styles, sizes, contact arrangements or variants may only be released by an extension to the approved manufacturers scope.

The normal specialist contractor to customer documentation will be the published CECC detail specification.
SECTION 7: TRAINING

The training programme shall be declared and the following elements as a minimum shall be covered.

- initial training of operatives by the approved manufacture
- initial training of supervisory staff by the approved manufacturer
- training records
- re-training

Evidence of satisfactory initial training carried out by the approved manufacturer shall be made available to the ONS prior to granting approval. Subsequent training of Specialist Contractor operators may be carried out by experienced personnel. Re-training may be necessary before any additional product lines or modifications are introduced by the specialist contractor.
SECTION 8: POST SUPPLY LIAISON

The specialist contractor shall demonstrate that he provides customer support for his service after supply. The contractor shall thus define his policy and procedures with respect to:-

- general guidelines for the collection of field reliability data by the analysis of customer rejected goods.

- such results shall be reported periodically to the approved manufacturer.
## ANNEX A

### EXAMPLE MATRIX

<table>
<thead>
<tr>
<th>PROCESS STAGE</th>
<th>QUALITY FACTOR</th>
<th>CRITICAL PARAMETER</th>
<th>AUDIT CHECK</th>
<th>PROCESS SPECIFICATION</th>
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<tbody>
<tr>
<td>Incoming goods/kitting</td>
<td>Material quality</td>
<td>Shelf life</td>
<td>Yes/No</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Visual (free from damage or defects)</td>
<td>How</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Correct part</td>
<td>How</td>
<td></td>
</tr>
<tr>
<td>Insert to shell assembly</td>
<td>Adhesive quality</td>
<td>Adhesive preparation</td>
<td>How</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process control</td>
<td>Thickness and location of adhesive</td>
<td>How</td>
<td>***</td>
<td></td>
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<tr>
<td></td>
<td>Cure temperature and time</td>
<td>Temp.</td>
<td>Time in</td>
<td>Time out</td>
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<tr>
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<td>Alignment of insert to shell datum</td>
<td>How</td>
<td>CECC 75 <em>00.</em>**</td>
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<td>Connector identification</td>
<td>Ink quality</td>
<td>Ink preparation</td>
<td>How</td>
<td>***</td>
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<tr>
<td></td>
<td></td>
<td>Storage conditions</td>
<td>How</td>
<td></td>
</tr>
<tr>
<td>Process control</td>
<td>Cleaning</td>
<td>How</td>
<td>***</td>
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<td></td>
<td>Application</td>
<td>How</td>
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<td></td>
<td>Visual inspection</td>
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<td>Temp.</td>
<td>Time in</td>
<td>Time out</td>
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<td>Test</td>
<td>Detail specification</td>
<td>Connector performance</td>
<td>Visual V.P. I.R.</td>
<td>CECC 75 <em>00.</em>**</td>
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<td>Adequate protection</td>
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</table>
ANNEX B

FORM AND CONTENT OF PROCESS SPECIFICATIONS

1. REQUIREMENTS

1.1 Quality Factors

A process specification shall be written for each quality factor.

1.2 Critical Parameters

For each quality factor relevant to a Process Specification, the manufacturer/specialist contractor shall state which parameters and the manufacturer will state the associated limits which are considered critical. Critical parameters are those which, when routinely measured and controlled, address the quality factor sufficiently well to ensure a consistent and acceptable output from the process stage under consideration. A critical parameter may be a process parameter (e.g. temperature) or a parameter measured on the item being processed or test vehicle; the process specification or referenced document should indicate which.

1.3 Associated Limits

The Process Specification shall define or make reference to associated limits and tolerances for each critical parameter.

2. SPECIALIST CONTRACTOR’S PROCESS SPECIFICATIONS

2.1 Aims and Content

Authors of process specifications should consider the following:

a) What materials, how specified, how assessed?
   - process requirements - What is required from the process?
   - control inputs - How is the process affected by external influences?

b) Process outputs: These include:
   - material outputs
   - observations, measurements and inspection results - What, how performed?
2.2 Process Specification Matrix

A convenient means of generating a Process Specification and at the same time, an audit check list, is shown in Annex A. Key points to note are:

(a) The natural progression from Process Stage through Quality Factor to Critical Factor is clearly shown. The example shown also includes a column for specific audit questions.

(b) Some critical parameters may require many levels of question, each requiring documented or observed evidence.

(c) The aim of a Process Specification is to describe how the specialist contractor controls the process step/quality factor under consideration.

2.3 Numbering of Process Specifications

Process Specifications prepared by the specialist contractors shall carry a unique and distinguishing number within the specialist contractor’s documentation system.

3. ADDITIONAL ITEMS (NOT MANDATORY) FOR CONSIDERATION IN A PROCESS SPECIFICATION

3.1 Drawings

Where the mechanical form of an item (e.g. shell to insert position) is critical the Process Specification should either include a drawing or make reference to such a drawing.