

SLOVENSKI STANDARD SIST CECC 200 025:2003

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Process Assessment Schedule: Printed board assembly facilities

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PROCESS
ASSESSMENT
SCHEDULE

CECC 200 025

May 1998

**Process Assessment Schedule:
Printed board assembly facilities**

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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 Process Assessment Schedule was prepared by :

Joint BSI EPL91/EPL52 Working Party, (Now EPL 501) UK
on behalf of Technical Committee CENELEC TC/CECC SC 91, Surface mount technology.

It is based, wherever possible, on publications of the International Electrotechnical Commission (IEC).

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Introduction

The CECC 200 000 series of specifications applies to Process Approval of specialist contractors to the electronic components industry in accordance with RP14 Part V. The mechanism of Process Approval is described in the Process Assessment Schedule (PAS) which defines how the principles given in RP14 Part V are applied to a given process activity or service.

PASs are a concept in CECC specifying in greater detail the manufacturing process and the associated quality factors. They are aimed at reducing or eliminating the need for costly end-of-line testing. PAS documentation also permits, where relevant, the application of Statistical Process Control techniques.

This specification describes the requirements that a Printed Board Assembly Facility must satisfy in order to obtain a CECC Specialist Contractor Approval for the manufacture of soldered printed board assemblies.

The Process Approval concept places emphasis on understanding of the technology concerned and on process control.

NOTE: The term "Assembly Facility" has been chosen to describe the assembly activity of both contract equipment manufacturers (CEMs) and original equipment manufacturers (OEMs).

1 General requirements

1.1 Scope

This PAS specifies the terms, definitions, symbols, quality system, assessment and verification methods, and other requirements relevant to the operation of a printed board Assembly Facility in compliance with the general requirements of the CECC System for electronic components of assessed quality.

Whereas Technology Approval requires that constituent added electronic components shall be CECC-approved, under the Process Approval system, printed boards and the components attached to them need not necessarily be CECC-approved items.

The use of CECC-approved added components and printed boards is recommended and where all of them are so released, the assembly may itself be released by the Assembly Facility under a CECC Certificate of Conformity. However, it is impractical to make the use of CECC-approved components mandatory and the wishes of the customer are of primary consideration. Where one or more non CECC-approved components are used in a specific assembly, the approved specialist Assembly Facility may release it as having been assembled using a CECC-approved process using the following wording : "This soldered printed board assembly is (or "These soldered assemblies are) released by a CECC-approved facility as having been assembled and tested using processes, methods and controls meeting the requirements of CECC 200 025".

1.2 Definitions and abbreviations

Definitions relevant to the technology in addition to those given in CECC RP14 Part V are given in Annex A. Where an Assembly Facility uses terms other than those found in Annex A, such terms shall be defined in the Assembly Facility's Process Manual.

Abbreviations are given in Annex G.

1.3 Related documents

1.3.1 Requirements

The Assembly Facility shall list all documents referenced in its Process Manual under the following, or similar, headings :

- documents referenced in the PAS
- other National or International Standards
- internal (i.e. Assembly Facility's own) issued documents

The list shall give full titles and reference numbers in respect of documents to which reference is made in the Process Manual. Subsequently, it is sufficient to quote the reference number only (for example, "EN ISO 9002").

1.3.2 Documents referenced in this PAS

EN 100114-1	Rule of procedure 14 - Quality Assessment Procedures Part 1: CECC requirements for the approval of an organization (RP14 Part I)
CECC 00 114-5	Rule of procedure 14: Quality assessment procedures Part 5: Process approval of specialist contractors within the electronic components industry (RP14 Part V)
CECC 00 200	CECC Qualified Products List
CECC 00 401	Glossary of abbreviations, terms and definitions of the CECC System
EN ISO 9000	Quality management and quality assurance standards - Guidelines for selection and use
EN ISO 9002	Quality systems - Model for quality assurance in production, installation and servicing
IEC 61189	Test methods for electrical materials, printed boards and other interconnection structures and assemblies
IEC 61191-1	Printed board assemblies -- Part 1: Generic specification - Soldered electrical and electronic assemblies using surface mount and related assembly technologies
IEC 61191-2	Part 2: Sectional specification - Surface mount soldered assemblies
IEC 61191-3	Part 3: Sectional specification - Through-hole mount soldered assemblies
IEC 61191-4	Part 4: Sectional specification - Terminal soldered assembly
IEC 61760-1	Surface mounting technology -- Part 1: Standard method for the specification of surface mounting components (SMDs)
CECC 200 003	Technical assessment schedule for printed board manufacturing facilities
CECC 200 012	Process assessment schedule for printed board design facilities

1.4 Units, symbols and terminology

Units, graphical 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 60027	Letter symbols to be used in electrical technology
IEC 60050	International electrotechnical vocabulary
IEC 60617	Graphical symbols for diagrams
ISO 1000	SI units and recommendations for the use of their multiples and of certain other units

Any other units, symbols and terminology peculiar to the processes or services covered by this PAS shall be taken from the relevant IEC or ISO documents, listed under "Related documents".

NOTE: All terms and concepts specifically relating to Process Approval are explained in RP14 Part V, in other parts of RP14 or in CECC 00 401. Specialist assemblers who are unfamiliar with these documents are advised to study them.

1.5 Quality system

The Assembly Facility shall establish and maintain a quality system satisfying the requirements of EN ISO 9002, as invoked by RP14 Part I and RP14 Part V. Certain of these requirements receive particular attention and are developed further in the following subclauses of this PAS.

In carrying out the appraisal of an Assembly Facility, the ONS shall take account of any relevant certificate to EN ISO 9002 issued by an organisation declared competent to do so by the appropriate national authority.

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1.6 Rework and repair of printed board assemblies

1.6.1 Rework

Rework is defined in Annex A and may be carried out optionally to correct process deviations that are within the allowable process limits or as a mandatory operation where it is necessary to rectify errors classed as 'unacceptable'.

Rework is carried out either by means not differing from the current manufacturing process (reprocessing), or by the rework processes as permitted by the relevant Process Approval document(s)/ Process Assessment Schedule(s) or by a combination of both; and using methods that do not cause unacceptable degradation of the reliability of the assembly.

Where the purchaser of an assembly, or any other third party, performs an electrical test or visual inspection that may not have been carried out by the original approved facility and non-conformance occurs, provided the assembly has not been released, it may be reworked by any facility approved to carry out the type of rework used, retested and inspected to the original applicable standard and then be released either by the original approved assembly facility, or by any other facility approved under this specification.

When the pre-release rework is carried out by an unapproved assembly facility or any other unapproved organisation, the assembly shall not be claimed as having been manufactured and released under this specification or under any other CECC specification.

1.6.2 Repair

Repair is defined in Annex A. Under the CECC system for release of approved components or of assemblies made using processes of assessed quality by an approved facility, repaired products may not be re-released as conforming with the original or any other CECC specification, even though they may be tested and found to meet the requirements.

2 Quality requirements of the process sequence

2.1 Process description

The activities covered by this PAS are :

- The manufacture, electrical test and subsequent control of subcontracted electrical testing of soldered printed board assemblies (Class A), or,
- The manufacture and electrical test of soldered printed board assemblies (Class B).

A Process Approval for this activity shall fall into one of the two categories (Class A or Class B) set out in 2.1.1 and 2.1.2.

The Assembly Facility shall declare the extent of the processes or services for which approval is sought, indicating how they fall within the scope of this PAS. Class A or Class B facilities may operate as independent assembly houses or as part of larger organisations, e.g., as OEMs.

NOTE: It is a requirement that both Class A and Class B Assembly Facilities shall have the ability to perform either in-circuit or functional electrical tests, (preferably both), or physical (e.g., thermal, X-ray) means of assessing joint integrity. Because the quality of soldered joints cannot be properly assessed using visual inspection alone, shipment of completely untested assemblies is not an acceptable procedure for release of assembled circuits under this specification.

The contract to supply printed board assemblies is between the customer and the Assembly Facility, not between the customer and the electrical test organisation.

When the Assembly Facility designs in or supplies components or other parts, it shall be the responsibility of the customer to confirm the suitability thereof for the relevant application.

The Assembly Facility shall be capable of undertaking in-house printed board assembly and electrical testing as set out in their declared abstract of Process Approval. If it does not have the necessary facilities in-house, the Assembly Facility may subcontract the manufacture of assembly tooling, inspection and test tooling and other hardware and the preparation of machine control software.

If required by the customer, it may also perform or subcontract the reliability testing (environmental stress testing) of assemblies that are within its claimed product structural range. However, where release of an assembly as a CECC-approved component is required, such testing shall be carried out either :

- by a CECC-approved test house,
- or by a test house acting under the supervision of the Assembly Facility's CECC System Manager.

On receipt of an order for printed board assembly from a customer, the Assembly Facility shall translate the customer's requirements into a practical soldered assembly using only those processes that are within the scope of the approval.

Responsibility for investigating faults and implementing corrective action shall be agreed between the Assembly Facility and the Customer, depending on the nature of the defect(s) and the available investigative equipment.

Assemblies made under this class of PAS may be released either under a CECC Certificate of Conformity or with a Certificate stating that the assembly has been carried out by an approved Assembly Facility within the CECC system. Refer to 1.1.

The Assembly Facility shall be capable of undertaking in-house printed board assembly and electrical testing as set out in their declared abstract of Process Approval and shall appoint a CECC System Manager (CSM) and define his/her relevant responsibilities in assuring that the requirements of this specification are met.

An Assembly Facility approved to Class A is permitted to act under Class B.

2.1.1 Class A Assembly Facility

- (1) An Assembly Facility capable of undertaking printed board assembly and electrical testing services and releasing assemblies to the customer and with the ability to assemble printed boards against a customer's order and subcontract the electrical test of such assemblies to suitably equipped organisations and after carrying out any necessary rework, may release the tested assemblies to the customer.
- (2) It may subcontract electrical testing that is outside the range of its own test capability only to an organisation which is suitably equipped for such testing and which does not further subcontract it. For each assembly type tested, the Assembly Facility shall verify by inspection that the equipment used does not impose stresses that can impair the reliability of the assembly.
- (3) The Assembly Facility shall receive the externally tested assemblies into its own bonded store, from which it may release them either under a CECC Certificate of Conformity or with a Certificate stating that the assembly has been carried out by an approved facility within the CECC system. Refer to 1.1.
- (4) Any printed board assemblies to be returned by the customer shall be directed to the Assembly Facility, since it is between those two bodies that the contract exists. Responsibility for investigating faults and implementing corrective action shall be agreed between the Class A Assembly Facility the Customer and the testing subcontractor, depending on the nature of the defect(s) and the available investigative equipment.

2.1.2 Class B Assembly Facility

An Assembly Facility capable of undertaking printed board assembly and electrical testing services and releasing assemblies to the customer without subcontracting any part of the assembly process or electrical testing.

2.2 Quality Factors

Quality Factors are those aspects of the process and of the Assembly Facility's organisation that significantly affect the quality and reliability of the service provided.

For each Quality Factor listed in the Process Manual, the Assembly Facility shall identify the critical parameters as in table 1 below. Critical parameters are those which, when routinely verified and controlled, address the quality factor sufficiently well to ensure a consistent and acceptable output from the process stage under consideration.

Table 1 identifies examples of parameters that a Assembly Facility may consider critical for the mandatory Quality Factors :

Table 1 : Example matrix of critical parameters

Quality factors	Critical Parameters
Competence in the technology. See Annex F 1.1.	<ul style="list-style-type: none"> - Experience of manufacturing team in claimed technologies. - Design team knowledge of layout and DFM of reliable structures.
Customer-supplier technical interface. See Annex F 1.2.	<ul style="list-style-type: none"> - Ability to advise on bareboard construction. - System for joint yield improvement projects. - Change control system and interface management procedures - List of changes requiring NSI/customer approval.
Procurement services. See Annex F 1.3.	<ul style="list-style-type: none"> - Planning and control of services. - Audits and monitoring of supplier performance and corrective actions. - Chasing procedures.
Customer-supplied items. See Annex F 1.4.	<ul style="list-style-type: none"> - Bill of Materials indicates who supplies what. - Respective goods-in inspection responsibilities defined. - Corrective action routines established. - Separation and control of customer property in stores and production (materials, jigs/fixtures, software). - Inventory status reporting to customer. - Insurance of customer property.
Quotations See Annex F 1.5.	<ul style="list-style-type: none"> - Review of customer specification. - DFM review. - Defining respective customer and assembler responsibilities. - Delivery plan - Contract agreement - as applicable.
Production planning. See Annex F 1.6.	<ul style="list-style-type: none"> - Receipt of design deliverables including intended processes. - Disciplined approach to scheduling and control of materials, equipment, labour resources for each customer project. - Effective communication with customer on customer-supplied items. - Timely advice to customers in case of delayed delivery.
Control of incoming goods quality. See Annex F 1.7.	<ul style="list-style-type: none"> - Suitable equipment available e.g., for solderability test, visual inspection, electrical test. - Procedures for liaison with suppliers on problems found.
Tools and equipment for assembly See Annex F 1.8.	<ul style="list-style-type: none"> - Adequate tools and equipment to cover claimed service and capability.
Control of product assembly and housekeeping. See Annex F 1.9.	<ul style="list-style-type: none"> - Availability of data file from the design source. - Availability of process/work instructions at each machine and workstation, including those on corrective action and scrapping. - Instructions and responsibilities if machine malfunction occurs. - Workmanship standards. - ESD control, operating requirements and implementation. - Solder paste control procedures. - Check for correct components before placement/insertion machine run. - Data collection after placement/insertion and prior to manual correction of positional errors. - Correct flux used (as agreed with customer). - Housekeeping cleanliness appropriate to application requirements. - Soldering equipment time-temperature profiles matched to individual board types and pastes (reflow only).

Quality factors	Critical Parameters
Control of product assembly (Cont'd). See Annex F 1.9.	<ul style="list-style-type: none"> - Technically valid system of process control, e.g., data collection on process deviations and non-conformance, analysis, feedback and corrective action. - Inventory and traceability controls. - Feedback relating production material yield problems to goods-in and purchasing actions where appropriate. - Ambient temperature control to suit processes and equipment
Control of cleaning (if req'd) See Annex F 1.10	<ul style="list-style-type: none"> - Checking of products for cleanliness against required specifications - Checking performance of cleaning equipment
Control of rework. See Annex F 1.11.	<ul style="list-style-type: none"> - Instructions for avoidance of rework. - Rework equipment/tools to be used for each component type defined. - Special training.
Control of test equipment See Annex F 1.12	<ul style="list-style-type: none"> - Test equipment validation and calibration. - Test data collection and feedback. - Monitoring subcontractor control of test equipment.
Control of software. See Annex F 1.13.	<ul style="list-style-type: none"> - Documented software management system in all departments. - Verification of correct software on production line prior to use. - Change control procedures. - Back-up copies and storage thereof. - Control of software used by sub-contractors.
Control of Subcontractors. See Annex F 1.14.	<ul style="list-style-type: none"> - Selection system based on capability and quality. - List of subcontractors. - Electrical test services defined and performance audited. - Environmental test services identified and tests specified. - Methods of data transfer to and from subcontractor. - Technical review of purchase orders prior to issue.
Health and Safety. See Annex F 1.15.	<ul style="list-style-type: none"> - Health and Safety instructions for all equipment, materials and processes available and observed. - Supplier's Health and Safety data for purchased items available to affected workforce personnel. - Procedures in place for handling and disposal of toxic and other process consumables.
Customer returns See Annex F 1.16.	<ul style="list-style-type: none"> - Written response to returns. - Verification of claimed faults. - Feedback and corrective action. - Liaison with subcontract test house(s).
Training See Annex F 1.17.	<ul style="list-style-type: none"> - Compliance with the requirements of EN ISO 9002.
Packaging, release and despatch. See Annex F 1.18	<ul style="list-style-type: none"> - Handling to avoid ESD and mechanical damage to assemblies. - Marking and labelling. - Effective control of CECC release procedures.
Commercial interface. See Annex F 1.19.	<ul style="list-style-type: none"> - Continual monitoring of customer enquiries, orders and contracts. - Preparation of CDSs. - Post-supply liaison.

Each relevant Quality Factor shall be referenced in a Process Specification (e.g., an existing Work Instruction) that states how the Assembly Facility shall identify and monitor these factors, and that shall explain how control of these factors supports an acceptable product or service.

2.3 Process specifications

The Assembly Facility shall apply Process Specifications which address the issues given in Annex B. Each process step included in the declared capability shall be included. These Process Specifications may be issued separately by the Assembly Facility or may be included within the Assembly Facility's Process Manual.

The Assembly Facility's design rule recommendations and its inspection or verification procedures shall be embodied in these Process Specifications.

2.4 Demonstration, verification and validation programmes

2.4.1 Demonstration

Demonstration is the act of proving to a customer or third party that the claims made by the Assembly Facility can be met in practice.

2.4.2 Verification

The Assembly Facility shall establish and declare a mechanism for ensuring that the service and overall capability that is offered in the Facility's promotional, sales and marketing literature is at all times consistent with, and adequately supported by, the Process Manual, Process Specifications and related documents.

The ONS shall verify that this is the case before the Assembly Facility may proceed with validation.

2.4.3 Validation

Initial validation of the Assembly Facility's in-house process is effected by processing the Test Vehicle(s) described in 2.4.4. During and/or after the validation programme. The ONS shall review the procedures and controls applied during the exercise (from initial acceptance of the order to completion of deliverable items) to ensure that all provisions of the Process Manual, Process Specifications and related documents have been observed, including any agreed specific in-process and end-of-process workmanship standards.

The Assembly Facility shall demonstrate its observance of all the criteria stipulated in its Process Manual or Process Specifications, except where modified by the requirements of the chosen Test Vehicle. However any modifications to the normal criteria must be in the direction of greater severity or complexity.

Satisfactory completion of the validation programme will normally result in an approval being recommended by the ONS, and the issue of an approval certificate by the ONH.

2.4.4 Test Vehicle

The Test Vehicle(s) for validation shall consist of a collection of one or more customer assembly, or other assemblies that are agreed by the Assembly Facility and the ONS as being representative of the declared abstract of Process Approval.

2.5 Maintenance programmes

Maintenance of approval shall be demonstrated by a combination of ongoing verifications and periodic audits.

The Assembly Facility shall, within a two year cycle, conduct an audit programme which encompasses all the requirements of RP14 Part I, RP14 Part V and CECC 200 025.. Clause 4 of this PAS details further audit criteria.