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QC 210018

First edition
2004-10

Ferrite cores –
Technology approval schedule (TAS)

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FERRITE CORES – TECHNOLOGY APPROVAL SCHEDULE (TAS)

FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62398, which is a technical specification, has been prepared jointly by IEC technical committee 51: Magnetic components and ferrite materials, and the IEC Quality Assessment System for Electronic Components (IECQ-CECC).

The text of this Technical specification is based on the following documents:

Enquiry draft	Report on voting
51/765/DTS	51/785/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

The QC number, which is the specification number in the IECQ-CECC, is QC 210018.

This publication has been partially drafted in accordance with the ISO/IEC Directives, Part 2 (2001). It also follows the requirements given in IEC QC 210000:1995, Technology Approval Schedules – Requirements under the IEC Quality Assessment System for Electronic Components (IECQ-CECC), available on the IECQ-CECC web site www.iecq-cecc.org.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this Technical specification may be issued at a later date.

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INTRODUCTION

The IEC Quality Assessment System for Electronic Components (IECQ-CECC) is composed of those member countries of the International Electrotechnical Commission (IEC) that 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 specifications and quality assessment procedures for electronic components and by the granting of an internationally recognized mark or certificate of conformity. The components produced under the System are acceptable in all member countries without further testing.

This TAS has been prepared for use by those countries taking part in the System who wish to issue national harmonized specifications for Technology Approval of Manufacturers of ferrite cores. It should be read in conjunction with the current regulations of the IECQ-CECC System.

At the date of printing of this specification the member countries of IECQ-CECC are Austria, China, Denmark, Finland, France, Germany, India, Japan, Republic of Korea, Norway, Russian Federation, Thailand, United Kingdom, USA and Yugoslavia. Copies of this specification can be obtained from their National Authorized institutions, National standard Organizations or, in case of difficulty, from the Central Office of IEC in Geneva, Switzerland (email info@iec.ch or fax 41 22 9190300) as described in the Specifications List QC 001004 (see www.iecq-cecc.org).

The requirements for Technology Approval of manufacturers of electronic and electromechanical components are given in QC 001002-3, Clause 6. The procedures for approval defined in that Clause requires the manufacturer to have available an appropriate Technology Approval Schedule (TAS).

This schedule defines how the principles and requirements of QC 001002-3, Clause 6 are applied to ferrite cores. In particular it defines minimum technical requirements which must be met by a manufacturer writing a Technology Approval Declaration Document (TADD) in accordance with Annex C of QC 001002-3, Clause 6.

Organizations responsible for preparing the present TAS

IEC Technical committee 51: Magnetic components and ferrite materials.

Preface

This schedule was prepared by TC51/WG1.

FERRITE CORES – TECHNOLOGY APPROVAL SCHEDULE (TAS)

1 General

1.1 Scope

This TAS defines the terms, definitions, symbols, quality system, test, assessment and verification methods and other requirements relevant to the design, manufacture and supply of ferrite cores in compliance with the general requirements of the IECQ-CECC System for components of assessed quality.

1.2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050, *International Electrotechnical Vocabulary (IEV)*

IEC 60133, *Dimensions of pot-cores made of magnetic oxides and associated parts*

IEC 60205, *Calculation of the effective parameters of magnetic piece parts*

IEC 60401-1, *Terms and nomenclature for cores made of magnetically soft ferrites – Part 1: Terms used for physical irregularities*

IEC 60401-2, *Terms and nomenclature for cores made of magnetically soft ferrites – Part 2: Reference of dimensions*

IEC 60401-3, *Terms and nomenclature for cores made of magnetically soft ferrites – Part 3: Guidelines on the format of data appearing in manufacturers' catalogues of transformer and inductor cores*

IEC 60431, *Dimensions of square cores (RM-cores) made of magnetic oxides and associated parts*

IEC 60617-DB:2001[1], *Graphical symbols for diagrams*

IEC 61185, *Magnetic oxide cores (ETD-cores) intended for use in power supply applications – Dimensions*

IEC 61246, *Magnetic oxide cores (E-cores) of rectangular cross-section and associated parts – Dimensions*

IEC 61247, *PM-cores made of magnetic oxides, and associated parts – Dimensions*

IEC 61596, *Magnetic oxide EP-cores and associated for use in inductors and transformers – Dimensions*

IEC 61631, *Test method for the mechanical strength of cores made of magnetic oxides*

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[1] "DB" refers to the IEC on-line database.

IEC 62044 (all parts), *Cores made of soft magnetic materials – Measuring methods*

ISO 497, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units*

QC 200000, *Process assessment schedules for requirements under the IEC Quality Assessment System for Electronic Components (IECQ) for approval of specialist contractors' processes and/or products within the electronic components industry*

QC 210000, *Technology Approval Schedules – Requirements under the IECQ Quality Assessment System for Electronic Components* (IECQ)

1.3 Units, symbols and terminology

Units, graphical symbols, letter symbols and terminology shall, whenever possible, be taken from the following publications:

IEC 60027, *Letter symbols to be used in electrical technology*;

IEC 60050, *International Electrotechnical Vocabulary (IEV)*;

IEC 60617-DB:2001, *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 shall be taken from the relevant IEC or ISO documents listed under Normative references.

1.4 Standard and preferred values

Technology Approval allows core dimensions and characteristics to be selected to suit each customer, and so preferred values are therefore not mandatory. However, when there are not over-riding customer needs, it is recommended that the established preferred values for core dimensions and A_L values are utilised. These may be found in the following publications:

IEC 60133, *Dimensions of pot-cores made of magnetic oxides and associated parts;*

IEC 60431, *Dimensions of square cores (RM-cores) made of magnetic oxides and associated parts;*

IEC 61185, *Magnetic oxide cores (ETD-cores) intended for use in power supply applications – Dimensions;*

IEC 61246, *Magnetic oxide cores (E-cores) of rectangular cross-section and associated parts – Dimensions;*

IEC 61247, *PM-cores made of magnetic oxides, and associated parts – Dimensions;*

IEC 61596, *Magnetic oxide EP-cores and associated for use in inductors and transformers – Dimensions.*

Nominal values of the inductance factor A_L should preferably be taken from the R10 series of ISO 497. When other values have been used, these should be taken from another series in that standard.

1.5 Terms and definitions

For the purposes of this TAS, the main definitions required can be found in the following publications:

IEC 60050, *International Electrotechnical Vocabulary*

IEC 60401-1, *Terms and nomenclature for cores made of magnetically soft ferrites – Part 1: Terms used for physical irregularities*

IEC 60401-2, *Terms and nomenclature for cores made of magnetically soft ferrites – Part 2: Reference of dimensions*

IEC 60401-3, *Terms and nomenclature for cores made of magnetically soft ferrites – Part 3: Guidelines on the format of data appearing in manufacturers' catalogues of transformer and inductor cores*

If any other terms and definitions are needed, the manufacturer shall supply them in the TADD.

2 Definition of the component technology

2.1 Scope

The manufacturing technology of ferrite cores can be split in two main processes (see Annex A):

– powder production;
– core production.

2.2 Description of activities and flow charts

The manufacturer shall identify the all process steps used in his ferrite core manufacturing technology and include relevant flow charts. This may include different processes for the various core shapes and material grades. The procedures documenting each process step including process control shall be referenced.

The following is an example of process:

– design;
– powder production;
– shaping;
– sintering;
– machining.

NOTE Test are performed all along the process according to manufacturing flow chart given in Annex A.

2.3 Technical abstract

The manufacturer shall prepare a technical abstract describing the range of products covered by the approval, referencing appropriate limits and boundaries where applicable.

The technical abstract shall be provided for inclusion in QC 001005, Register of Firms, Products and Services approved under the IECQ System, including ISO 9000. An example of such an abstract is given in Annex B.

3 Component design

3.1 Scope

The design of ferrite cores involves setting the following target properties:

– shapes;
– dimensions;
– electrical and magnetic parameters;
– mechanical parameters;
– marking and packing.

In any case, the performance requirements shall be clearly stated in the Customer Detail Specification (CDS) or other detail specification.

The design process involves the choice of appropriate material and process.

3.2 Description of activities and flow charts

The manufacturer shall provide documentation and flow charts describing each of the stages in the design process. An example of a design flow chart is given in Annex C.

3.3 Interfaces

The designer shall take into account the interface with different parties as mentioned in the following Subclauses:

3.3.1 Design/manufacture

As the ferrite core design activity cannot proceed without the production of trial batches on production equipment, close co-operation is necessary between design and manufacturing. The manufacturer will assist this co-operation by defining carefully the responsibilities of each department in the design process.

3.3.2 Customer/user

When the manufacturer is designing a ferrite core for a specific customer requirement, the manufacturer shall have a systematic method (for example a questionnaire) for unambiguously ascertaining the needs of the customer. Where certain parametric values do not need to be precisely defined, the manufacturer shall advise the customer of preferred values. See also 6.5.2 of this TAS. After discussions with the customer, the manufacturer shall have a documented system confirming the design agreement which has been made, and registration of detail specifications and other documentation as required by QC 001002-3, Clause 6.

3.3.3 Subcontractor

Subcontracting of design is permitted only if the part subcontracted is not related to the main technical process for which TA is being requested. Appropriate Process Assessment Schedules (PASs) should be referenced (see QC 001002-3, Clause 5 and QC 200000).

Where the design is to be subcontracted, the manufacturer shall specify the following:

– reason for subcontracting;
– name and address of the subcontractor and contact person;
– contract specification.

4 Manufacture

4.1 Scope

This Clause describes the activities, equipment and rework rules for the manufacture of ferrite cores and gives requirements for the validation of control processes and subcontractors.

4.2 Description of activities and flow charts

The manufacturer shall describe all the production processes and include flow charts showing all activities, critical steps, process check points and quality indicators (see Annex A).

4.3 Equipment

The manufacturer shall list the equipment and indicate its intended purpose in the manufacturing flow chart. He shall describe or refer to documentation describing its operation and the methods used to monitor and control its performance, including regular maintenance programs. If any equipment requires special calibration or adjustment other than routine calibration of measuring equipment, the manufacturer shall describe this fully.

4.4 Rework

Rework is permitted provided the methods of rework are documented and the manufacturer has conducted trials to validate the rework methods and has shown that the reworked ferrite cores are equal in performance to those, which have not been reworked.

4.5 Validation and control of the processes

The manufacturer shall describe the methods used for the validation and control of the process. Validation will show that the process control in operation is adequate to control ferrite core performance on parameters, which can be affected within the limits which the manufacturer has declared for those parameters.

The process control methods shall wherever possible be statistical controls. Typical examples of the parameters, which may be measured to effect control, are given in the boxes with double borders in the flow charts in Annex A (Figures A.1 and A.2).

4.6 Subcontractors

Subcontracting of manufacture is permitted only if the part subcontracted is not related to the main technical process for which TA is being requested. Appropriate Process Assessment Schedules (PASs) should be referenced (see QC 001002-3, Clause 5 and QC 200000).

Where manufacture is to be subcontracted, the manufacturer shall specify the following:

– reason for subcontracting;
– name and address of the subcontractor and contact person;
– contract specification.

5 Assembly

Not applicable to ferrite cores.

6 Testing

6.1 Scope

This Clause covers testing involved in process control, lot-by-lot conformance testing, testing to verify that the inspection requirements of a Customer Detail Specification (CDS) have been met, and testing involved in process boundary verification and product verification.

6.2 Description of activities and flow charts

When the manufacturer prepares a manufacturing flow chart following the example of Annex A, he shall include in the process control the parameters to be measured and shall reference the procedure describing the method of measurement. Lot-by-lot testing according to the manufacturer's catalogue specification or according to a CDS shall be carried out either on a 100 % or on a sampling basis as described in the relevant specification. To support the performance claims made for his ferrite cores and to validate his processes, the manufacturer shall periodically test samples from production according to tests defined by himself. The manufacturer shall produce a schedule showing his program of periodic testing, and detailing the type of test, its periodicity, the sampling scheme and the main test parameters.

6.3 Equipment

The manufacturer shall describe the type and performance of the test equipment. The information shall cover:

– electrical parameter tested;
– conditions of test (applied voltages, frequency, etc.);
– test jigs required for use with measuring equipment;
– environmental test equipment.

6.4 Test procedures

The preferred test methods should be in accordance with the IEC 62044 series. Otherwise the test procedures shall be fully described.

6.5 Interfaces

6.5.1 Subcontractors

Testing for process control shall not be subcontracted. Initial product qualification tests and periodic tests as described in Subclause 6.2 may be subcontracted provided the test laboratory is accredited for the relevant tests.

Where testing is to be subcontracted the manufacturer shall specify the following:

– reason for subcontracting;
– name and address of the subcontractor and contact person;
– contract specification.

6.5.2 Verification of customer specifications

The manufacturer shall have documented procedures for handling customer specifications and implementing special test procedures or other requirements, which may be specified in them.

Following the guidelines in Figure D.1 of QC 210000, the manufacturer shall provide an outline for a customer to write a CDS. The manufacturer shall have a formal procedure for reviewing each CDS with the customer.

7 Verification

7.1 Process boundary verification

The manufacturer's TADD shall define methods for verification of component technology including:

a) rationale for the selection of the evaluation methods;

b) test procedures or measurement system description;

c) description of tools and techniques used for qualification;

d) description of test vehicles and their relationship to end products;

e) periodic testing.

Examples of test vehicles are:

– reference test toroid or cores for powder release;

– production ferrite cores.

7.2 Product verification

Product verification shall be in accordance with customer requirements or applicable standards. The manufacturer shall make the reference to test plans in his TADD which demonstrate his ability to meet the design limits which are claimed in the Technology Technical Abstract for all the design features listed in 3.1.

8 Process characterisation

8.1 Identification of process characteristics

The manufacturer shall give details of the methods used for the determining of relationships between process parameters and process outputs or product characteristics required for the characterisation of:

– current processes;

– newly introduced processes.

He shall include the following key elements of process characterisation:

a) measurement system evaluation for ensuring data integrity;

b) identification of a standard of measurement for capability and continuous improvement assessments;

c) application of statistical methods for determining parameter relationship, performing diagnostics, assessing potential capability using experimentation and stimulating continuous improvement.

8.2 Description of activities

The manufacturer shall give a complete description of his process characterisation activities, with particular attention to the following:

a) measurement parameter, for example, electrical mechanical or physical and the measurement system evaluation to ensure data integrity;

b) the stage(s) at which the measurement(s) should be made and the relationship with product parameters;

c) rationale for:
   – description of critical parameters,
   – parameter selection,
   – measurement system selection.

Flow charts may be used to present or supplement this information.

9 Packing and shipping

9.1 Description of activities and flow charts

The manufacturer shall describe packing and shipping activities, and may include relevant flow charts. Examples of the activities are following:

– protection against environmental conditions;
– protection against damage;
– documentation and labelling.

9.2 Interfaces

9.2.1 Verification of customer requirements

The manufacturer shall state his procedure for checking and validating the customer's requirements.

9.2.2 Subcontracting

Where packing and shipping are to be subcontracted, the manufacturer shall specify the following:

– reason for subcontracting;
– name and address of the subcontractor and contact person;
– technical specification;
– interface documentation.

9.3 Validity of release

Ferrite cores shall be released for delivery according to standard IECQ-CECC requirements after the quality conformance inspection prescribed in the relevant detail specification has been carried out.

10 Withdrawal of Technology Approval

Technology Approval may be withdrawn only by the body which granted it, and only if one or more of the following conditions apply:

a) at the request of the manufacturer;
b) if the production of ferrite cores declared in the TADD is terminated or suspended for a specified period;
c) if the rules of procedure are not correctly applied;
d) manufacturer's approval is withdrawn.

Annex A
(informative)

Production process flow charts

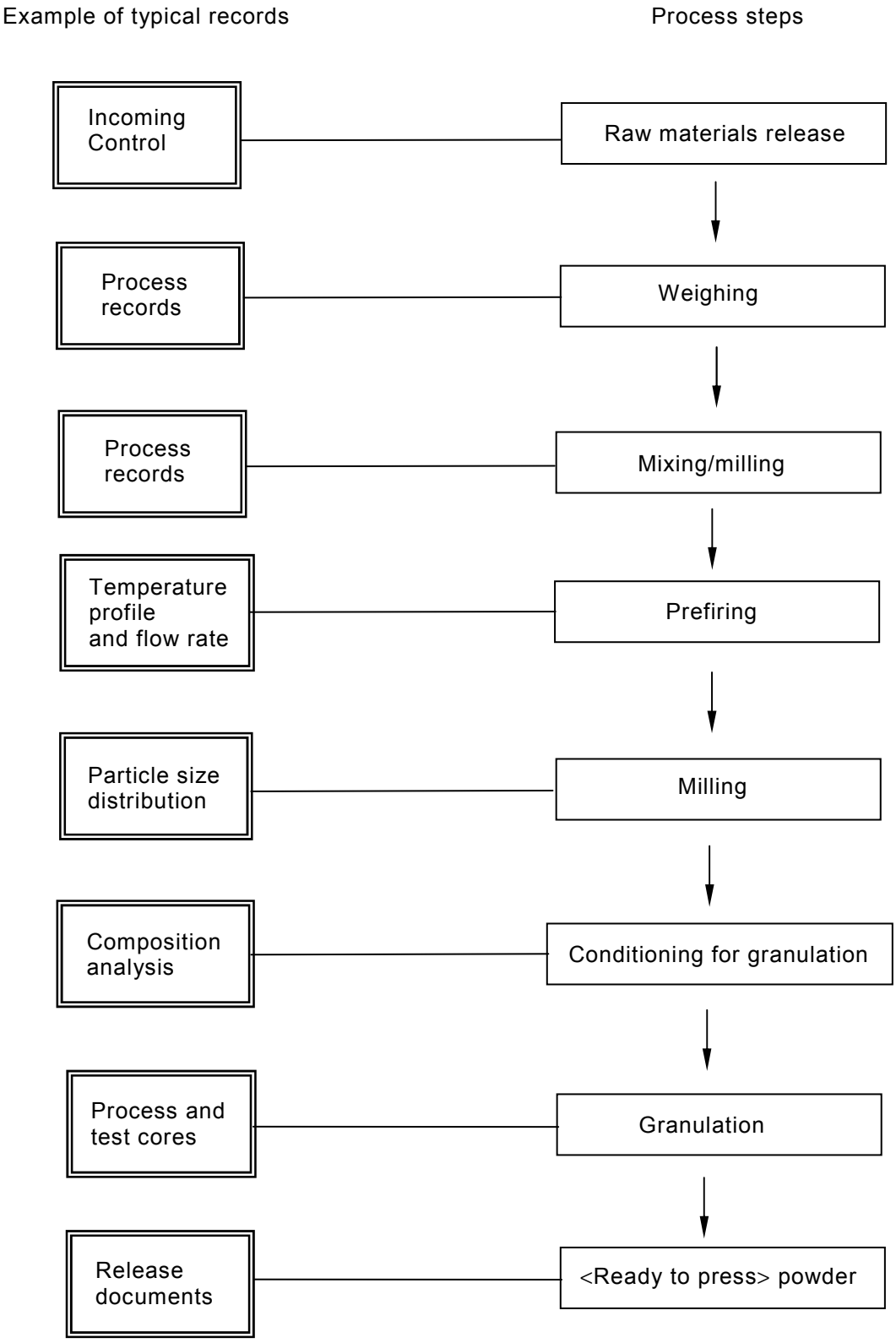

Figure A.1 – Powder production process flow chart

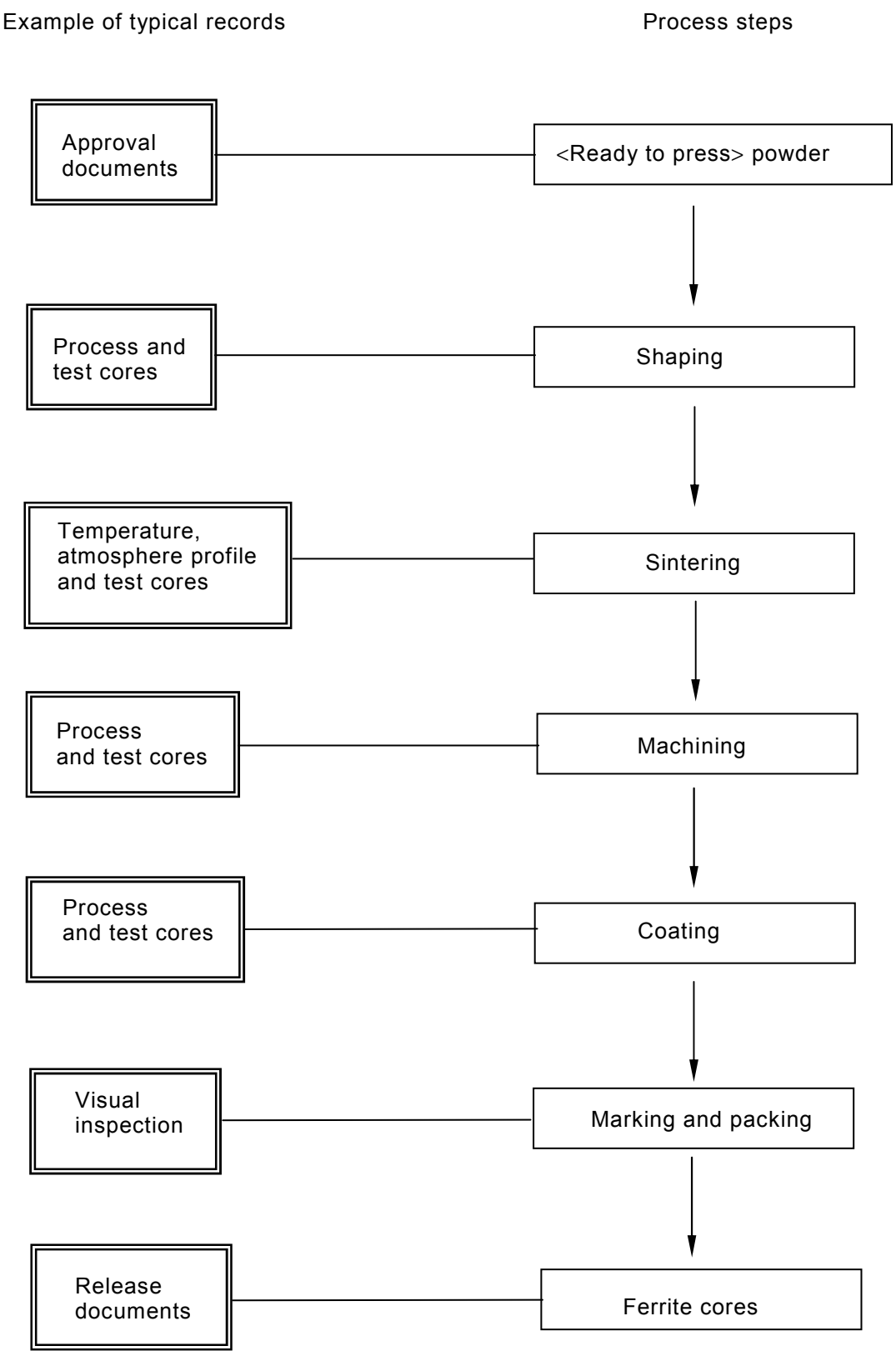

Figure A.2 – Core production process flow chart

Annex B
(informative)

Example of layout of technical abstract

Example of layout of Technical Abstract for inclusion in QC 001005.

– certificate number;
– issue;
– date;
– product description, for example: ferrite cores for power application (MnZn ferrite material);
– manufacturer;
– Technology Approval Declaration Document (reference and date).

From the example product description above – *Ferrite cores for power application (MnZn ferrite material)* – the following list shall include all major performances claimed in the TADD.

– dimensions and tolerances;
– A_L value and tolerance;
– power loss;
– amplitude permeability;
– mechanical strength.

NOTE The limits of performances listed above may not be simultaneously available. Refer to the manufacturer for information.

Other product descriptions will define their relevant major performances.

Annex C
(informative)
Example of design flow chart

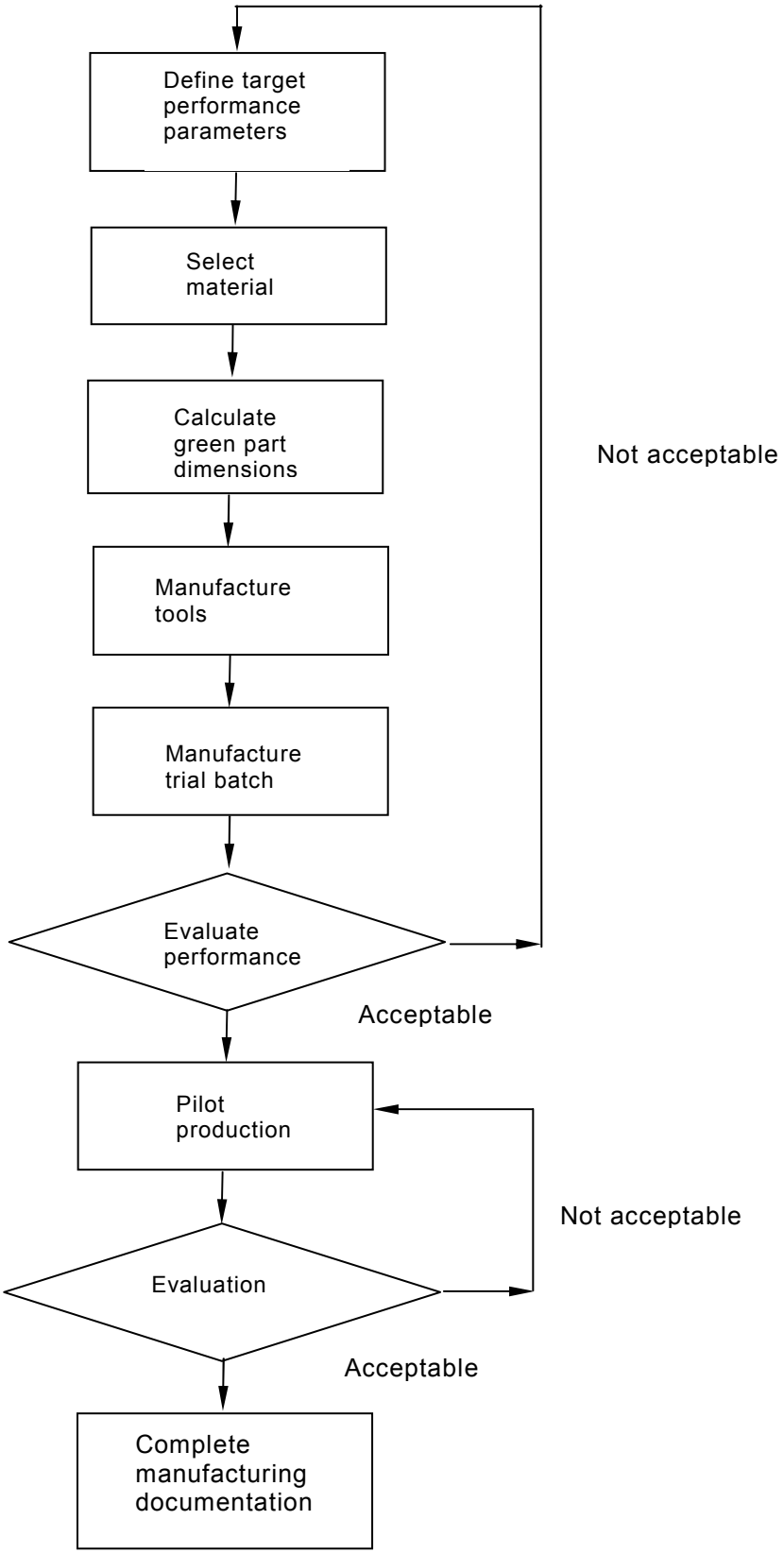

Figure C.1 – Example of design flow chart

———————

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