

ANSI/IEEE Std 392-1976



IEEE
Std 392-1976

IEEE Recommended Practice for Achieving High Reliability in Electronics Transformers and Inductors

Approved June 9, 1977 by the American National Standards Institute

Dec 15, 1976

SH06262

IEEE Std 392-1976



PUBLISHED BY

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, Inc.
345 EAST 47 STREET, NEW YORK, N. Y. 10017



Documents

Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25, 2026 at 13:33:32 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 392-1976

**IEEE
Std 392-1976**

IEEE Recommended Practice for Achieving High Reliability in Electronics Transformers and Inductors

Sponsor
**Electronics Transformers Technical Committee
of the
IEEE Magnetics Society**

© Copyright 1976 by

The Institute of Electrical and Electronics Engineers, Inc

*No part of this publication may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.*

 **Documents**
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25, 2026 at 13:33:32 UTC from IEEE Xplore. Restrictions apply.

Approved September 4, 1975

IEEE Standards Board

Joseph L. Koepfinger, *Chairman*

Warren H. Cook, *Vice Chairman*

Sava I. Sherr, *Secretary*

Jean Jacques Archambault
Robert D. Briskman
Dale R. Cochran
Louis Costrell
Frank Davidoff
Jay Forster
Irvin N. Howell, Jr.

Stuart P. Jackson
Irving Kolodny
William R. Kruesi
Benjamin J. Leon
Anthony C. Lordi
Donald T. Michael
Voss A. Moore
William S. Morgan

William J. Neiswender
Gustave Shapiro
Ralph M. Showers
Robert A. Soderman
Leonard Thomas
Charles L. Wagner
William T. Wintringham

Foreword

(This Foreword is not a part of IEEE Std 392-1976, IEEE Recommended Practice for Achieving High Reliability in Electronics Transformers and Inductors.)

This publication is intended to provide guidelines to systems and transformer engineers for the design and manufacture of transformers and inductors of high reliability. For the sophisticated applications of these components such as manned space vehicles, satellites, missiles, and under-sea telephone systems, reliability is imperative because of the high cost of a component failure.

Improving reliability in the manufacture of transformers and inductors primarily involves attention to detail coupled with close controls in all phases of manufacture. However, the efforts expended in improving reliability also increase costs which must be evaluated by the user. As a result, the reliability effort will often depend on what the customer is willing to pay.

This publication was prepared by the Working Group on Transformer Reliability of the Insulations Systems Subcommittee of the Electronics Transformers Technical Committee of the IEEE Magnetics Society. The Working Group consisted of the following members

T. L. Tanner, *Chairman*

F. B. Colby
E. I. Cooper
J. L. Davis

M. W. Garay
D. S. Jones
P. McClure

D. E. Rohrer

When the Electronics Transformers Technical Committee approved this Standard the membership was as follows:

H. I. Tillinger, *Chairman*

J. D. Schwartz, *Vice-Chairman and Secretary* **H. S. Mitsanas, *Vice-Chairman***

R. Fischer
W. B. Fritz
Paul Goethe
A. D. Hasley
Ordean Kiltie
L. W. Kirkwood *

H. W. Lord
R. Lee
C. H. Nicholson
E. F. Schroeder
H. F. Storm

J. Tardy
L. E. Unnewehr
J. P. Whistler
A. A. Toppeto
R. G. Wolpert
†R. O. McCary

†Standards Liaison Representative for Magnetics Society

*Chairman of the Subcommittee

Contents

SECTION	PAGE
1. Scope	5
2. Service Environment	5
3. Definitions	5
4. Design Engineering	5
4.1 Responsibilities	5
4.2 Customer Requirements	5
4.3 Design Philosophy	6
4.4 Documentation	7
4.5 Design Review	7
5. Personnel and Manufacturing Controls	7
5.1 Personnel Considerations	7
5.2 Facilities	7
5.3 Materials	7
5.4 Traceability	7
5.5 Documents and Records	8
5.6 Certification	8
6. Testing	8
6.1 Preliminary Testing	8
6.2 Qualification Testing	9
6.3 Lot-Acceptance Testing	9
6.4 Life Testing	10
6.5 Reliability Testing	11
6.6 Failure Analysis	11
7. Quality Assurance	11
7.1 Overall Requirements	11
7.2 Incoming Material Inspection	12
7.3 Inspection Equipment and Devices	12
7.4 Product Inspection	12
7.5 Inspection Records	13
8. Control Specification	13
8.1 General and Specific Specifications	13
8.2 Organization of the Specification	13
9. Bibliography	14
TABLES	
Table 1 Physical and Environmental Tests	9
Table 2 Group A Tests	9
Table 3 Group B Tests	10
FIGURE	
Fig 1 Functional Interactions	6

IEEE Recommended Practice for Achieving High Reliability in Electronics Transformers and Inductors

1. Scope

This document is a guide to the design and manufacture of transformers and inductors for use in sophisticated systems such as manned space vehicles, satellites, missiles, and undersea telephone systems where high reliability¹ is imperative because of the impossibility or high cost of replacement. Such components are usually made for a particular circuit application in small lots and at irregular intervals with consequent higher unit costs. This document describes the types of tests and methods of inspection of materials and workmanship to ensure reliable transformers and inductors for use in demanding applications or inaccessible systems.

2. Service Environment

The environment in which transformers and inductors covered by this recommended practice must operate depends upon the application. The environment may include ranges of humidity, temperature, altitude, hydrostatic pressure, vibration, shock, and radiation, unusual mountings, and nonflammability requirements.

3. Definitions

Many of the technical terms used in this recommended practice are defined in the following references:

IEEE Std 100-1972, IEEE Standard Dictionary of Electrical and Electronics Terms (ANSI C42.100-1972)

¹ High reliability in this document refers to an item that is not generally available in the market place but which is designed and manufactured, at higher procurement costs for demanding applications, with considerable care to reduce possibilities of failure.

ASQC Standard A3, Glossary of General Terms Used in Quality Control

IEC 271 (1974), List of Basic Terms, Definitions, and Related Mathematics for Reliability

4. Design Engineering

4.1 Responsibilities. The design group is responsible for the actual design, manufacturing information (that is, detailed drawings, processes, and procedures), and testing procedures according to the customer's requirements. After production has been initiated, the design group should check the production control data for deviations that could adversely affect the reliability of the shipped product. When extreme reliability is imperative, an engineer with applicable technical knowledge, and desirably a quality control background, should be assigned to the manufacturing area to provide constant surveillance and technical assistance.

Decisions made by design engineers (that is, what tests are required, whether serialization is necessary, etc) on the extent of controls placed on manufacturing will, of course, be reflected in the costs of units delivered to the customer.

Fig 1 shows the functional interactions discussed in this section and those that follow.

4.2 Customer Requirements. The design engineering group is responsible for designing the component that meets the customer's needs and technical requirements. These requirements are formalized in the official procurement document, the control specification (see Section 8), prepared by or for the customer. This is the controlling document in regard to the design, manufacture, intended use, and operating conditions of the component. It also stipulates the tests to be made and require-