

American National Standard

adopted by the
DEPARTMENT
OF
DEFENSE
see acceptance notice on
inside front cover

relays and relay systems associated with electric power apparatus

ANSI/IEEE C37.90-1978



american national standards institute, inc.

Acceptance Notice

This non-Government document was adopted on 18 July, 1983, and is approved for use by the DoD. The indicated industry group has furnished the clearance required by existing regulations. Copies of the document are stocked by the DoD Single Stock Point, Naval Publications and Forms Center, Philadelphia, PA, 19120, for issue to DoD activities only. Contractors and Industry groups must obtain copies directly from IEEE, 345 East 47th Street, New York, NY 10017.

Title of Document: **IEEE Standard Relays and Relay Systems**
Associated with Electric Power Apparatus

Document No: **ANSI/IEEE C37.90-1978**

Date of Specific Issue Adopted: **23 June, 1978**

Releasing Industry Group: **The Institute of Electrical and**
Electronics Engineers, Inc

Custodians:
Army — ME
Navy — YD
Air Force — 85

Military Coordinating Activity:
Navy — YD

Project Number: 6110-0258

Review Activity:
Army — ME
Air Force — 99
Navy — SH
GLA — GS

NOTICE: When reaffirmation, amendment, revision, or cancellation of this standard is initially proposed, the industry group responsible for this standard shall inform the Military Coordinating Activity of the proposed change and request their participation.

ANSI/IEEE
C37.90-1978
(Revision of
ANSI C37.90-1971)

An American National Standard

**IEEE Standard Relays and
Relay Systems Associated with
Electric Power Apparatus**

Sponsor

**Power System Relaying Committee of the
IEEE Power Engineering Society**

Secretariat

Electrical and Electronics Technical Advisory Board

Approved September 9, 1976

Reaffirmed March 11, 1982

IEEE Standards Board

Approved June 23, 1978

Reaffirmed April 4, 1983

American National Standards Institute

© Copyright 1978 by

**The Institute of Electrical and Electronics Engineers, Inc
345 East 47th Street, New York, NY 10017, USA**

*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

IEEE Standards documents are developed within the Technical Committees of the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Board. Members of the committees serve voluntarily and without compensation. They are not necessarily members of the Institute. The standards developed within IEEE represent a consensus of the broad expertise on the subject within the Institute as well as those activities outside of IEEE which have expressed an interest in participating in the development of the standard.

Use of an IEEE Standard is wholly voluntary. The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE Standard is subjected to review at least once every five years for revision or reaffirmation. When a document is more than five years old, and has not been reaffirmed, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE Standard.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments.

Interpretations: Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of all concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason IEEE and the members of its technical committees are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration.

Comments on standards and requests for interpretations should be addressed to:

Secretary, IEEE Standards Board
345 East 47th Street
New York, NY 10017
USA

Foreword

(This Foreword is not a part of ANSI/IEEE C37.90-1978, American National Standard Relays and Relay Systems Associated with Electric Power Apparatus.)

This revision of ANSI C37.90-1971 (IEEE Std 313-1971) contains three major changes in content and organization as described below.

(1) The section on definitions of relay terms has been eliminated on the basis that these definitions also appear in ANSI C37.100-1972, Definitions for Power Switchgear. In the future, ANSI C37.100 will be the principal reference source for definitions of relay terms in the power switchgear field.

(2) A new section describing the Surge Withstand Capability (SWC) test has been added. The description of this test was first published in 1974 as ANSI C37.90a-1974 (IEEE Std 472-1974), Guide for Surge Withstand Capability (SWC) Tests (supplement to ANSI C37.90-1971, IEEE Std 313-1971). Any further revision of C37.90a-1974 will take precedence over Section 9, Surge Withstand Capability Tests.

(3) Clauses and tables have been added to the section on ratings to show performance data which should be provided by a manufacturer in published information on auxiliary relays.

In addition to these changes, other significant changes have been made in Section 6, Ratings and in Section 8, Dielectric Tests.

In preparing this standard, consideration has been given to the work of other committees, and especially to international standards which have been published or which are under preparation by Technical Committee 41 of the International Electrotechnical Commission (IEC).

The major work in preparing the material for this revision was carried out by the Relay Standards Subcommittee of the Power System Relaying Committee of the Power Engineering Society of the Institute of Electrical and Electronics Engineers.

Suggestions for improvement of this standard will be welcome. They should be sent to the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018, with a copy to the Secretary, IEEE Standards Committee, Institute of Electrical and Electronics Engineers, Inc, 345 East 47th Street, New York, N.Y. 10017.

Membership of the Relay Standards Subcommittee during the period of revision of this document consisted of:

C. A. Mathews, *Chairman*

J. W. Chadwick	R. J. Kuhr	F. N. Meissner
D. Dalasta	W. A. Lewis	W. K. Morrison
R. E. Dietrich	J. R. Linders	M. Rosen
C. M. Gadsden	J. W. Lipnitz	R. J. Sullivan
G. E. Heidenreich	G. Lokken	F. Von Roeschlaub
J. A. Imhof	G. J. Marieni	C. L. Wagner

The Subcommittee on Protective Relays of American National Standards Committee C37 on Power Switchgear was directly responsible for the revision and approval of this document as an American National Standard. At the time it completed its review of the standard, it had the following personnel:

G. J. Marieni, *Chairman*

J. W. Chadwick	J. R. Linders	M. B. Purvis
R. J. Felton	J. W. Lipnitz	M. Rosen
C. H. Griffin	G. Lokken	R. J. Sullivan
J. L. Koepfinger	C. A. Mathews	F. Von Roeschlaub

When the IEEE Standards Board approved this standard on September 3, 1976, it had the following membership:

William R. Kruesi, *Chairman*

Irvin N. Howell, Jr., *Vice Chairman*

Ivan G. Easton, *Secretary*

William E. Andrus
Jean Jacques Archambault
Dale R. Cochran
Warren H. Cook
Louis Costrell
Jay Forster
Joseph L. Koepfinger

Irving Kolodny
Benjamin J. Leon
Anthony C. Lordi
John P. Markey
Thomas J. Martin
Donald T. Michael
Voss A. Moore
William S. Morgan

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

†Deceased

Contents

SECTION	PAGE
1. Definition of a Relay	7
2. Scope	7
3. Purpose	7
4. Classification of Relays, Relay Systems, and Related Terminology	7
4.1 Classification of Relays by Functions	7
4.2 Classification of Relays by Input.	8
4.3 Classification of Relays by Operating Principles or Structures.	8
4.4 Classification of Relays by Performance Characteristics	8
4.5 Terminology Relating to Relay Operating and Performance Characteristics	9
4.6 Terminology Relating to Structural Components	9
4.7 Terminology Relating to Relay Environment	9
4.8 Terminology Relating to Protective Methods and Systems and Their Performance	10
5. Service Conditions	10
5.1 Usual Service Conditions.	10
5.2 Unusual Service Conditions.	10
6. Ratings.	11
6.1 Standard Current and Voltage Ratings for Relays	11
6.2 Allowable Variation from Rated Voltage	11
6.3 Maximum Design Voltage and Current for Relays.	11
6.4 Range of Operating Voltage for Auxiliary Relays and other Functions.	11
6.5 Test for Operation at Minimum Voltage — Auxiliary Relays.	11
6.6 Make and Carry Ratings for Tripping Contacts	12
6.7 Published Data for Auxiliary Relays	12
7. Heating (Temperature Limitations)	12
7.1 Limits of Temperature Rise for Coils	12
8. Dielectric Tests.	14
8.1 General	14
8.2 Standard Test Voltages	14
8.3 Duration and Application of Test Voltage.	14
8.4 Dielectric Tests at Point of Manufacture	14
8.5 Dielectric Tests by Users	14
8.6 Temperature at which Dielectric Tests are to be Made	14
8.7 Points of Application of Voltage.	14
8.8 Frequency and Waveshape of Test Voltage	14
8.9 Measurement of Test Voltage	14
9. Surge Withstand Capability (SWC) Tests	14
9.1 Introduction	14
9.2 General	14
9.3 Surge Withstand Capability (SWC) Waveshape and Characteristics	15
9.4 Equipment to be Tested	15
9.5 Application of Test Wave	17
FIGURES	
Fig 1 General Makeup of a Relay System with Communications or Computer Interface, or both, Showing Points to be Subjected to the SWC Test	15
Fig 2 General Makeup of a Relay System Without Communications or Computer Interface Showing Points to be Subjected to the SWC Test.	16

FIGURES	PAGE
Fig 3 Application of the Common Mode Test	17
Fig 4 Application of the Transverse Mode Test	17
TABLES	
Table 1 Maximum Design Voltage for dc Auxiliary Relays	11
Table 2 Limits of Temperature Rise for Coils	12
Table 3 Contact Rating for All Relays.	12
Table 4 Operating Data for All Relays.	13
Table 5 Operating Data for Relays with Intermittent Ratings	13
Table 6 Test Requirements for the Various External Connection Groups of a Relay System ..	18
APPENDIXES	
APPENDIX A SWC Test Supporting Evidence and Bibliography	21
A1 Supporting Evidence	21
A2 Bibliography	22
APPENDIX FIGURES	
Fig A1 Typical SWC Test Circuit.	21
Fig A2 Control Circuit Transient Data	22
APPENDIX B Graphical Illustrations of Relay Terminology	25
APPENDIX FIGURES	
Fig B1 (a) Operating Characteristic of Distance Relays; (b) Operating Characteristics of Distance Relays that are Inherently Directional.	25
Fig B2 Relationship of Relay Operating Time for Electromechanical Relays	26
Fig B3 Typical Operating Characteristic Curve Shapes of Various Inverse-Time Relays.	26

An American National Standard

IEEE Standard Relays and Relay Systems Associated with Electric Power Apparatus

1. Definition of a Relay

An electric device designed to respond to input conditions in a prescribed manner and after specified conditions are met to cause contact operation or similar abrupt change in associated electric control circuits.

NOTES:

(1) Inputs are usually electrical but may be mechanical, thermal, or other quantities, or a combination of quantities. Limit switches and similar simple devices are not relays.

(2) A relay may consist of several relay units, each responsive to a specified input, with the combination of units providing the desired overall performance characteristic of the relay.

2. Scope

This standard applies only to relays and relay systems used to control power switchgear. It does not cover relays of types designed primarily for industrial control, for switching of communication or other low-level signals, or any other equipment not intended for the control of power equipment.

3. Purpose

The purpose of this standard is to specify standard service conditions, standard ratings, and requirements for testing of relays and relay systems associated with power apparatus.

4. Classification of Relays, Relay Systems, and Related Terminology

Definitions of relay terms are not included in this standard. Refer to ANSI C37.100-1972, Definitions for Power Switchgear, for defini-

tions of relay terms.¹

Relay terminology covers a wide area from the detailed relay structural principles through complex power system relay applications. The terminology in this field can be classified in several different manners. The following is believed to be the most comprehensive.

4.1 Classification of Relays by Functions. The following basic areas of power system relay applications provide a convenient method of relay classification.

4.1.1 Protective Relay. A protective relay may be classified according to its input quantities (see 4.2), operating principles (see 4.3), or performance characteristics (see 4.4).

4.1.2 Regulating Relay. Regulating relays can be classified according to 4.2, 4.3, or 4.4.

4.1.3 Monitoring Relay. Typical monitoring relays include:

- alarm relay
- fault detector relay
- network phasing relay
- synchronism-check relay
- verification relay.

4.1.4 Programming Relay. Typical program relays include:

- accelerating relay
- initiating relay
- network master relay
- phase-selector relay
- reclosing relay
- synchronizing relay.

4.1.5 Auxiliary Relay. Typical auxiliary relays include:

- blocking relay
- closing relay

¹Illustrations of some of the basic definitions are shown in Appendix B.