

ANSI
C37.24-1971

IEEE
Std 144-1971

IEEE STANDARDS
ARCHIVES
DO NOT REMOVE

An American National Standard

*IEEE Standard Guide for
Evaluating the Effect of
Solar Radiation on
Outdoor Metal-Clad Switchgear*

IEEE Std 144-1971 — ANSI C37.24-1971



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 24, 2026 at 15:46:53 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 144-1971

An American National Standard

***IEEE Standard Guide for
Evaluating the Effect of
Solar Radiation on
Outdoor Metal-Clad Switchgear***

Sponsor

**Switchgear Committee of the
IEEE Power Engineering Society**

Approved September 15, 1970

IEEE Standards Committee

Secretariat

Electrical and Electronics Technical Advisory Board

Approved July 14, 1971

American National Standards Institute

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

© Copyright 1971 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.*

Foreword

(This Foreword is not a part of American National Standard and IEEE Standard Guide for Evaluating the Effect of Solar Radiation Outdoor Metal-Clad Switchgear, ANSI C37.24-1971, IEEE Std 313-1971)

The original Guide for Evaluating the Effect of Solar Radiation on Outdoor Metal-Clad Switchgear was prepared as a Committee Report by the Switchgear Assemblies Subcommittee of the AIEE Switchgear Committee. This Report was presented as a Technical Paper at the AIEE Winter General Meeting in New York, N. Y., January 18-22, 1954. In October 1955, it was issued by the AIEE Standards Committee as Publication 955.

The May 31, 1962, revision extended the original Guide to include the 3000-ampere rating of metal-clad equipment. The temperature reference base was also changed from the "average daily highest temperature" to the "monthly normal maximum temperature" as provided by the U. S. Weather Bureau in Technical Paper No. 9 for the years 1921-1950. Similar Canadian temperature data was extracted from Bulletin CDS-7-59 provided by the Department of Transport, Toronto, Ont., Canada.

The U. S. Weather Bureau has advised that Technical Paper No. 31 is now superseded by "Climatography of the United States Nos. 81-1 through 81-45." The temperature data in this revision is taken from the superseding document. It is also updated to cover the periods between 1931 and 1960.

The major work in preparing this document was carried out by the following members of the Switchgear Assemblies Subcommittee of the Switchgear Committee of the Power Engineering Society of the Institute of Electrical and Electronics Engineers:

C. P. West, Chairman, Original Report

H. G. Frus	H. L. Lowe	G. M. Reed
J. M. Geiger	F. W. McCloska	B. K. Sturgis
W. G. Harlow	I. S. Mendenhall	J. W. Timmerman
R. M. Jolly	G. H. Moorhead, Jr.	

H. F. White, Chairman, Revised Report

G. M. Bostian	L. J. Himes	R. H. Rutter
T. G. Brennan	R. M. Jolly	J. M. Shulman
H. J. Chambers	J. J. Mikos	W. H. Smith
J. J. Dravis	G. O. Perkins	B. K. Sturgis
H. G. Frus	W. F. Preston	S. H. Telander
L. L. Gleason	P. D. Raymond	H. B. Wortman

It is the policy of both the Institute of Electrical and Electronics Engineers and American National Standards Committee C37 to maintain this standard current with the state of technology. Comments on this standard, as well as suggestions for additional material that should be included are invited. These should be addressed to the American National Standards Institute, 1430 Broadway, New York, N. Y. 10018, with copy to the Secretary, IEEE Standards Committee, Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, N. Y. 10017.

The American National Standards Committee on Power Switchgear, C37, which reviewed and approved this standard, had the following personnel at the time of approval:

V. L. Cox, *Chairman* W. R. Wilson, *Vice-Chairman*
J. G. Werner, *Secretary*

Organization Represented

Association of American Railroads
Association of Iron and Steel Engineers
Electric Light and Power Group

Name of Representative

W. O. Muller
T. S. Novak
H. W. Grissler
R. R. Wagstaff
J. E. Beehler
H. G. Frus
J. P. Markey (*Alt*)
F. R. Solis (*Alt*)



<i>Organization Represented</i>	<i>Name of Representative</i>
Institute of Electrical and Electronics Engineers	J. E. Conner H. L. Lowe J. B. Owens H. O. Simmons, Jr G. W. Walsh H. C. Barnes (<i>Alt</i>) W. A. Carter (<i>Alt</i>) R. E. Friedrich (<i>Alt</i>) W. A. Hall (<i>Alt</i>)
National Electrical Manufacturers Association	W. R. Wilson R. W. Dunham A. P. Colaiaco C. E. Gryctko W. J. Smith B. K. Sturgis J. G. Werner (<i>Alt</i>)
Tennessee Valley Authority	O. S. C. Hammer
U.S. Department of the Army	W. K. Cave
U.S. Department of the Navy	Norman Mawdsley L. W. Johnson (<i>Alt</i>)
U.S. Department of the Interior, Bureau of Reclamation	E. M. Tomsic
U.S. Department of Defense, Defense Communications Agency	C. D. Friday

When the IEEE Standards Committee approved this standard on September 15, 1970, it had the following membership:

B. B. Barrow, *Chairman*

S. I. Sherr, *Secretary*

E. C. Barnes
F. K. Becker
R. C. Cunningham
W. H. Devenish
C. J. Essel
R. F. Estoppey
J. P. Fitzgerald
D. C. Fleckenstein

J. A. Goetz
A. D. Hasley
A. R. Hileman
D. T. Michael
E. H. Myers
F. M. Oberlander
A. M. Okun
J. B. Owens
R. H. Rose

G. Shapiro
H. H. Smith
S. V. Soanes
F. G. Timmel
H. P. Westman
W. T. Wintringham
C. J. Wylie
W. N. Zippler

Contents

SECTION	PAGE
1. Introduction	7
2. Scope	7
3. Purpose	7
4. Operating Limitations	7
5. External Influences on Internal Operating Temperatures	8
5.1 Ambient Temperatures	8
5.2 Solar Radiation	9
5.3 Wind Influence	10
6. Ventilation and Condensation Control	10
7. Current-Carrying Capabilities of Switchgear	10
8. Suggested Modifications of Standard Designs	11
9. Conclusion	11
10. Bibliography	19
TABLES	
Table 1. 30-Year Monthly Normal Maximum Temperature in Degrees Fahrenheit, United States	12
Table 2. 30-Year Monthly Normal Maximum Temperature in Degrees Fahrenheit, Canada	18
FIGURES	
Fig. 1. Relation Between Recorded Data for Solar Irradiation on a Horizontal Surface and a Sine Function Curve	9
Fig. 2. Current–Temperature Relationship for Outdoor Metal- Clad Switchgear Including the Effect of a Typical Solar Cycle of 97-Watts-Per-Square-Foot Maximum Amplitude as Shown in Fig. 1 on Standard 1200-, 2000-, and 3000-Ampere Units	10