SLOVENSKI
STANDARD

SIST EN 62270:2005

september 2005

Avtomatizacija hidroelektrarn – Vodilo za računalniški krmilni sistem (IEC 62270:2004)

Hydroelectric power plant automation – Guide for computer-based control (IEC 62270:2004)

ICS 27.140

Referenčna številka
SIST EN 62270:2005(en)

EUROPEAN STANDARD **EN 62270**

NORME EUROPÉENNE

EUROPÄISCHE NORM July 2004

ICS 27.140

English version

Hydroelectric power plant automation - Guide for computer-based control
(IEC 62270:2004)

Automatisation
de centrale hydroélectrique -
Guide pour la commande
à base de calculateur
(CEI 62270:2004)

Automatisierung von Wasserkraftwerken -
Leitfaden zur computergestützten
Steuerung
(IEC 62270:2004)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in two official versions (English, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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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

The text of document 4/188/FDIS, future edition 1 of IEC 62270, prepared by IEC TC 4, Hydraulic turbines, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62270 on 2004-07-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2005-04-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2007-07-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62270:2004 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE Where an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 61158	Series	Digital data communications for measurement and control - Fieldbus for use in industrial control systems	EN 61158	Series
ANSI C63.4	2001	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz - 40 GHz	-	-
IEEE Std 100	1996	The IEEE Standard Dictionary of Electrical and Electronics Terms	-	-
IEEE Std 485	1997	IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications (ANSI)	-	-
IEEE Std 610	1990	IEEE Standard Glossary of Software Engineering Terminology (ANSI)	-	-
IEEE Std 1010	1987	IEEE Guide for Control of Hydroelectric Power Plants (ANSI)	-	-
IEEE Std 1014	1987	IEEE Standard for a Versatile Backplane Bus: VMEbus	-	-
IEEE Std 1020	1988	IEEE Guide for Control of Small Hydroelectric Power Plants (ANSI)	-	-
IEEE Std 1046	1991	IEEE Application Guide for Distributed Digital Control and Monitoring for Power Plants (ANSI)	-	-
IEEE Std 1147	1991	IEEE Guide for the Rehabilitation of Hydroelectric Power Plants (ANSI)	-	-
IEEE Std C37.1	1994	IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control (ANSI)	-	-
IEEE Std C37.90.1	2002	IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems (ANSI)	-	-

Publication	Year	Title	EN/HD	Year
IEEE Std C37.90.2	1995	IEEE Trial Use Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers (ANSI)	-	-
IEEE Std 1379	2000	IEEE Recommended Practice for Data Communications Between Remote Terminal Units and Intelligent Electronic Devices in a Substation (ANSI)	-	-
ISO/IEC 8802-3	2001	Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications	-	-
ISO/IEC 8802-4	1990	Part 4: Token-passing bus access method and physical layer specifications	-	-
ISO/IEC 8802-5	1998	Part 5: Token ring access method and physical layer specifications	-	-

INTERNATIONAL STANDARD

IEC 62270

First edition
2004-04

Hydroelectric power plant automation – Guide for computer-based control

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE XB

For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HYDROELECTRIC POWER PLANT AUTOMATION – GUIDE FOR COMPUTER-BASED CONTROL

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62270 has been prepared by IEC technical committee 4: Hydraulic turbines.

The text of this standard is based on the IEEE Standard 1249 (1996) *IEEE guide for computer-based control for hydroelectric power plant automation*. It was submitted to the national committees for voting under the Fast Track procedure as the following documents:

FDIS	Report on voting
4/188/FDIS	4/190/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

INTRODUCTION

Automation of hydroelectric generating plants has been a known technology for many years. Due to the relative simplicity of the control logic for hydroelectric power plants, the application of computer-based control has lagged, compared to other types of generating stations, such as fossil. Now that computer-based control can be implemented for comparable costs as relay-based logic and can incorporate additional features, it is being applied in hydroelectric power stations worldwide, both in new installations and in the rehabilitation of older plants.

HYDROELECTRIC POWER PLANT AUTOMATION – GUIDE FOR COMPUTER-BASED CONTROL

1 Overview

1.1 Scope

This standard sets down guidelines for the application, design concepts, and implementation of computer-based control systems for hydroelectric plant automation. It addresses functional capabilities, performance requirements, interface requirements, hardware considerations, and operator training. It includes recommendations for system testing and acceptance. Finally, case studies of actual computer-based automatic control applications are presented.

The automation of control and data logging functions has relieved the plant operator of these tasks, allowing the operator more time to concentrate on other duties. In many cases, the plant's operating costs can be significantly reduced by automation (primarily via staff reduction) while still maintaining a high level of unit control reliability.

Automatic control systems for hydroelectric units based on electromechanical relay logic have been in general use for a number of years and, in fact, were considered standard practice for the industry. Within the last decade, microprocessor-based controllers have become available that are suitable for operation in a power plant environment. These computer-based systems have been applied for data logging, alarm monitoring, and unit and plant control. Advantages of computer-based control include use of graphical user interfaces, the incorporation of sequence of events and trending into the control system, the incorporation of artificial intelligence and expert system capabilities, and reduced plant life cycle cost.

1.2 Purpose

This standard is directed to the practicing engineer who has some familiarity with computer-based control systems and who is designing or implementing hydroelectric unit or plant control systems, either in a new project or as a retrofit to an existing one. This standard assumes that the control system logic has already been defined; therefore, its development is not covered. For information on control sequence logic, the reader is directed to the IEEE guides for control of hydroelectric power plants listed in Clause 2 of this standard.

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 61158, *Digital data communications for measurement and control - Fieldbus for use in industrial control systems*

ANSI C63.4-2001, *Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz–40 GHz* [1]

IEEE Std 100-1996, *The IEEE Standard Dictionary of Electrical and Electronics Terms* [2]

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[1] ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

[2] IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

IEEE Std 485-1997, *IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications* (ANSI)

IEEE Std 610-1990, *IEEE Standard Glossary of Software Engineering Terminology* (ANSI).

IEEE Std 1010-1987 (Reaffirmed 1992), *IEEE Guide for Control of Hydroelectric Power Plants* (ANSI)

IEEE Std 1014-1987 *IEEE Standard for A Versatile Backplane Bus: VMEbus*

IEEE Std 1020-1988 (Reaffirmed 1994), *IEEE Guide for Control of Small Hydroelectric Power Plants.* (ANSI)

IEEE Std 1046-1991 (Reaffirmed 1996), *IEEE Guide for Distributed Digital Control and Monitoring for Power Plants* (ANSI)

IEEE Std 1147-1991 (Reaffirmed 1996), *IEEE Guide for the Rehabilitation of Hydroelectric Power Plants* (ANSI)

IEEE Std C37.1-1994, *IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automation Control (ANSI)*

IEEE Std C37.90.1-2002, *IEEE Standard for Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems (ANSI)*

IEEE Std C37.90.2-1995, *IEEE Trial Use Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers (ANSI)*

IEEE 1379: 2000, IEEE *Recommended Practice for Data Communications Between Remote Terminal Units and Intelligent Electronic Devices in a Substation (ANSI)*

ISO/IEC 8802-3:2001, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*[3] (ANSI/IEEE Std 802.3, 1996 Edition)

ISO/IEC 8802-4:1990 (Reaffirmed 1995), *Information processing systems – Local area networks – Part 4: Token-passing bus access method and physical layer specifications* (ANSI/IEEE 802.4-1990 Edition)

ISO/IEC 8802-5:1998, *Information technology –Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 5: Token ring access method and physical layer specifications* (ANSI/IEEE Std 802.5, 1995 Edition)

3 Terms and definitions

For the purposes of this document the definitions provided here reflect common industry usage as related to automation of hydroelectric power plants, and may not in all instances be in accordance with IEEE Std 100-1996, or IEEE Std 610-1990, or other applicable standards. For more rigorous definitions, or for definitions not covered herein, the reader is referred to the appropriate IEEE standards.

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[3] ISO publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembé, CH-1211, Genève 20, Switzerland/Suisse. ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

3.1
analog-to-digital (a/d) conversion
production of a digital output corresponding to the value of an analog input quantity

3.2
automatic control
arrangement of electrical controls that provides for switching or controlling, or both, of equipment in a specific sequence and under predetermined conditions without operator intervention

3.3
automatic generation control (AGC)
capability to regulate the power output of selectable units in response to total power plant output, tie-line power flow, and power system frequency

3.4
automatic voltage control (AVC)
capability to regulate a specific power system voltage, via adjustment of unit excitation within the limits of unit terminal voltage and VAR capability

3.5
automation hierarchy
design and implementation of automation functions in a multilevel structure, such as local level, group level, unit level, etc.

3.6
availability
ratio of uptime (system functional) to uptime plus downtime (system not functional)

3.7
backplane
circuit board with connectors or sockets that provides a standardized method of transferring signals between plug-in circuit cards

3.8
bridge
device that allows two networks of the same or similar technology to communicate

3.9
centralized control
control location one step removed from local control; remote from the equipment or generating unit, but still within the confines of the plant (e.g. controls located in a plant control room)

3.10
closed loop control
type of automatic control in which control actions are based on signals fed back from the controlled equipment or system. For example, a plant control system can control the power output of a multi-unit hydroelectric power plant by monitoring the total plant megawatt value and, in response, by controlling the turbine governors of each unit, change the plant power output to meet system needs

3.11
computer-based automation
use of computer components, such as logic controllers, sequence controllers, modulating controllers, and processors in order to bring plant equipment into operation, optimize operation in a steady-state condition, and shut down the equipment in the proper sequence under safe operating conditions