SLOVENSKI STANDARD
SIST CWA 14642:2004

01-november-2004

Dogovor delavnice CEN (CWA) ï Elektriļ ni vmesnik za hiġno soproizvodnjo ï Zahteve za povezave razdelilnega omreġja za mikro soproizvodne sisteme za domaļ o uporabo do 16 A na fazo v nizkonapetostnem razdelilnem omreġju (230/400 V)

CEN Workshop Agreement (CWA) - Electrical interface for domestic cogeneration - Requirements for distribution network connection for micro cogeneration systems for domestic use up to 16 A per phase in low-voltage distribution networks (230/400 V)

Ta slovenski standard je istoveten z: **CWA 14642:2003**

ICS:

27.010	Prenos energije in toplote na splošno	Energy and heat transfer engineering in general

SIST CWA 14642:2004 **en**

CEN WORKSHOP AGREEMENT

CWA 14642

January 2003

ICS 27.010

English version

CEN Workshop Agreement (CWA) - Electrical interface for domestic cogeneration - Requirements for distribution network connection for micro cogeneration systems for domestic use up to 16 A per phase in low-voltage distribution networks (230/400 V)

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties, the constitution of which is indicated in the foreword of this Workshop Agreement.

The formal process followed by the Workshop in the development of this Workshop Agreement has been endorsed by the National Members of CEN but neither the National Members of CEN nor the CEN Management Centre can be held accountable for the technical content of this CEN Workshop Agreement or possible conflicts with standards or legislation.

This CEN Workshop Agreement can in no way be held as being an official standard developed by CEN and its Members.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Content

Foreword

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties in September 2002, the constitution of which was supported by CEN following the public call for participation made in February 2001.

A list of the individuals and organizations which supported the technical consensus represented by the CEN Workshop Agreement is available from the CEN Management Centre. These organizations were drawn from the following economic sectors: manufacturers, testing and certification institutes, distribution network operators (DNO), European Commission.

The formal process followed by the Workshop in the development of the CEN Workshop Agreement has been endorsed by the National Members of CEN but neither the National Members of CEN nor the CEN Management Centre can be held accountable for the technical content of the CEN Workshop Agreement or possible conflict with standards or legislation. This CEN Workshop Agreement is not yet a standard developed by CEN and its members.

The final review/endorsement round for this CWA was started in August 2002 and was successfully closed in November 2002.The final text of this CWA was submitted to CEN for publication on 15 November 2002.

This CEN Workshop Agreement is publicly available as a reference document from the National Members of CEN: AENOR, AFNOR, BSI, COSMT, DIN, DS, ELOT, IBN/BIN, IPQ, IST, MSA, NEN, NSAI, NSF, ON, SEE, SIS, SFS, SNV, and UNI.

Comments or suggestions from the users of the CEN Workshop Agreement are welcome and should be addressed to the CEN Management Centre

Introduction

CHP, Combined Heat and Power, or cogeneration is the simultaneous production of heat and electricity. This proven technology produced in the year 2001 around 10% of Europe's electricity and heat requirements.

In recent years "micro-cogeneration" systems below 11 kVA have been developed. Within the micro-cogeneration technology one can differentiate between domestic applications (e.g. for households) and non-domestic applications (e.g. for hotels or swimming pools). Due to the lower running hours, saving on domestic cogeneration is quite different from commercial micro-cogeneration. In order to maximise the environmental benefits of domestic cogeneration these systems should be thermally led.

Micro-cogeneration is still an emerging technology and as such, lacks an appropriate standard for the electrical interface. Existing standards are applicable to other parts of a micro-cogeneration system. The technology for micro-cogeneration can be fuel cells, small gas engines, thermo-electric modules and Stirling engines (possibly in conjunction with heat pumps or solar boilers).

The expected growth of micro-cogeneration will follow the normal market penetration of a new technology. There is a need to address the initial market uptake for micro-cogeneration and this is the purpose of this document.

Generally electrical networks have been developed to be operated in a centralised manner, where large power plants produce electricity that is transported over long distances to provide power to many customers. In such a system the power flows in only one direction: from the power station through the network and to the customer.

With cogeneration systems the electricity can flow in two directions (from the cogeneration unit to the network and from the network to the site where the cogeneration unit is located). This can be a concern for the distribution utility[1], since the micro-cogeneration plant could be supplying energy into a section of the DNOs network either under fault or normal operating conditions, this may create problems for the safety of persons working on the network and the quality of the voltage supplied by the network. A need for appropriate co-ordination and technical rules exists. The way this problem has been dealt with so far varies from country to country. Whilst there are rules for distribution network interconnection that are appropriate for larger scale cogeneration systems, they were not designed for micro-cogeneration. In some European countries small-scale cogeneration systems can be connected to the low voltage network. However, existing rules for small-scale less than 1 MWe maybe make it onerous for the very small domestic micro-cogeneration systems to be operated.

If micro-cogeneration systems are not simple to connect and safe, they will never penetrate the domestic market successfully. It is necessary to formulate technical specifications that solve all technical issues at low costs. The specifications also need to be more straightforward and robust than for industrial customers, because domestic consumers are not technically skilled and therefore need more protection.

Widely accepted specifications will help to overcome the technical difficulties to connect micro-cogeneration systems to electrical networks and to reduce the associated costs. Furthermore, it should limit the risk of disputes between DNO and other parties (manufacturer, contractor and customer). The intention of this document is not to change existing local standards or practices immediately but is a recommendation of future good practice. It is built on growing experience of micro-cogeneration in Europe.

LV electrical installations are covered by IEC 60364 and CLC HD 384. In some countries national or local regulations apply, overriding these standards and the CWA.

This CEN Workshop Agreement applies to the electrical interface of micro-cogeneration systems for domestic use, up to 16 A per phase. It deals with notification procedures as well as technical specifications regarding safety and electrical co-ordination. Micro-cogeneration for domestic premises will therefore require being a "fit and inform" process that meets all the necessary requirements of the Distribution Network Operators.

Due to the practical difficulties as well as the lengthy procedure of developing an EN standard, it was decided to start with a CEN Workshop Agreement and to use it as input for the normal standardization process. As the CWA is a recommendation for good practice and not a standard national rules / recommendations shall take priority over the recommendations in the CWA. It was agreed that CEN will take over the Workshop Agreement, since CENELEC at that time did not have such a possibility. Future development of the CWA towards an EN standard will be transferred to CENELEC.

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[1] Utilities refers to private companies, national public or semi-public authorities responsible for the production and/or distribution of electricity

CWA participants

Advantica Technologies Ltd	United Kingdom
AEA Technology	United Kingdom
Alstom Research and Technology Centre	United Kingdom
BG Group	United Kingdom
GASTEC N.V.	The Netherlands
COGEN Europe	European organisation
Danish Standards Association	Denmark
DEFU	Denmark
DVGW-EBI	Germany
EA Technology Ltd	United Kingdom
ECOGEN - Serviços de Energia Descentralizada, S.A.	Portugal
ecopower energy solutions AG	Switzerland
EDF R&D / Normalisation	France
Electricité de France – Gaz de France Services	France
Electricity Association Services	United Kingdom
ENEL Distribuzione	Italy
EnergieNed	The Netherlands
GASTEC Certification B.V.	The Netherlands
GAZ De France	France
International Conference on Electricity Distribution CIRED	European organisation
Laborelec	Belgium
Netherlands Standardization Institute NEN	The Netherlands
NUON	The Netherlands
RWE Net AG	Germany
Sigma Elektroteknisk	Norway
TÜV Rheinland Product Safety	Germany
Université Catholique de Louvain, Unité TERM – Groupe Energie Biomasse	Belgium
Vaillant GmbH	Germany

NOTE Participation does not mean that all listed participants have agreed and accepted the final version of the CWA in all points as some may be in contradiction to existing national rules or guidelines (see Annex 1).

1 Scope

Micro-cogeneration is the generation of electricity and the recovery and use of the thermal energy supplying the needs of domestic premises. This CEN Workshop Agreement covers the electrical interface between the appliance and the low-voltage electrical network (nominal 230/400 V). Specific elements like metering are not included. The intention of the CWA is to recommend future good practice, noting that the CWA, local existing standards and practices may require modification in the future due to larger market penetration and the associated return of experience.

NOTE The CWA reflects a pan-European view on best practice for the connection of micro-cogeneration; however it may not be the most appropriate document for use in all countries and under all circumstances.

The following aspects are included in the scope:

- all technologies for micro-cogeneration are applicable;
- all generator types are applicable;
- the size is limited to a maximum of 16A per phase in a single low-voltage installation (nominal 230/400V)
- both 3-phase and single-phase connections are applicable;
- connection is limited to low voltage networks;
- the electrical interface is the principal focus and this includes the method of connection, the settings and protection requirements for connection, the operation of the electrical interface under normal conditions, emergency shutdown, distribution network-independent operation, start-up and distribution network synchronisation;
- this document relates to the electrical interface only as existing standards and directives apply to the other parts of the system;
- this document covers technical issues of connection.

NOTE The size is maybe increased up to 20 A (24 A) in accordance to the existing national standards in Germany, Austria, Netherlands. It is permitted, in these countries, to feed a higher current than 16 A into the public grid. There are similar requirements for the installation of special types of electrical appliances for domestic use (e.g. electrical water heater) with an amperage higher than 16 A.

The following aspects are excluded from the scope:

- units exceeding nominal 230/400V;
- single phase units that exceed 16 A;
- multi phase units that exceed 16 A per phase;
- multiple units that exceed 16 A per phase in aggregate, for one installation;
- issues of revenue rebalancing, metering or other commercial matters;
- generators never to be connected to the supply networks.

The intention of the CWA is to insure that micro-cogeneration satisfies appropriate provisions for:

- safety of persons;
- information to electricians working inside the house
- voltage quality;
- reliability of supply;
- protection of the cogeneration unit.

Requirements for automatic disconnection and isolation regulations for safety purposes are included, however the CWA does not cover the safety of DNO personnel or their contracted parties, as their safety is a combination of the electrical conditions and working instructions, which is the responsibility of the DNO. Labour safety of electricians working in the house is covered by other standards.

2 References

This CEN Workshop Agreement incorporates provisions from other publications in dated or undated reference,. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this CWA only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

Publication	Ref doc	Title
EN 50081-1		Electromagnetic compatibility (EMC) – Generic emission standard – Part 1: residential, commercial and light industry
EN 50082-1		EMC - Generic immunity standard – Part 1: residential, commercial and light industry
EN 50160		Voltage characteristics of electricity supplied by public distribution systems
EN 50178		Electronic equipment for use in power installations
EN 55014-1	CISPR 14-1	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission – Product family standard
EN 55014-2	CISPR 14-2	EMC – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard
EN 55022	CISPR 22	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
EN 60335-1		Safety of household and similar electrical appliances – Part 1: General requirements
EN 60730	IEC 60730	Automatic electrical controls for household and similar use
EN 61000-3-2	IEC 61000-3-2	EMC – Part 3-2: Limits - Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)
EN 61000-3-3	IEC 61000-3-3	EMC - Part 3-3: Limits - Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current up to 16 A
IEC 61000-6-1		Electromagnetic compatibility (EMC) - Part 6: Generic standards - Section 1: Immunity for residential, commercial and light-industrial environments
IEC 61000-6-3		Electromagnetic compatibility (EMC) - Part 6: Generic standards - Section 3: Emission standard for residential, commercial and light-industrial environments
IEC 61009-1		Residual current operated circuit-breakers with integral over-current protection for household and similar uses (RCBOs) - Part 1: General rules
HD 384	IEC 60364 modified	Electrical installations of buildings
IEC 60050		International Electrotechnical Vocabulary (IEV) - 151: Electrical and magnetic devices - 195: Earthing and protection against electrical shock - 411: Rotating machinery - 442: Electrical accessories - 448: Power system protection - 601: Generation, transmission and distribution of electricity - General - 603: Generation, transmission and distribution of electricity – Power systems planning and management - 811: Electric traction - 826: Electric installations of buildings
IEC 61140		Protection against electric shock – Common aspects for installation and equipment

3 Terms and definitions[2]

For the purpose of this CWA, the following definitions apply.

Appliance
An assembly of components to fulfil one or more functions and provided with a cover to protect the user from hazards and the assembly from damage. To exchange energy, information, etc., an appliance has connecting electric wires, fuels supply, water pipes and flue gas pipes etc.

For a micro-cogeneration appliance, the typical assembly consists of

- For gas engines and Stirling engines, an engine to convert fuel to mechanical power, mechanical to electrical conversion (generator, alternator, and/or inverter), electrical interface (synchronisation device, inverter, interface protection).
- For fuel cells, typical systems consist of a chemical-to-electrical power conversion, an inverter and electrical interface.

The electrical interface monitoring- and control-functions may be incorporated into the micro-cogeneration unit, or may be fitted as a discrete remotely mounted device. In either case the micro-cogeneration unit and its electrical interface comprise the appliance and must contain also an isolating switch.

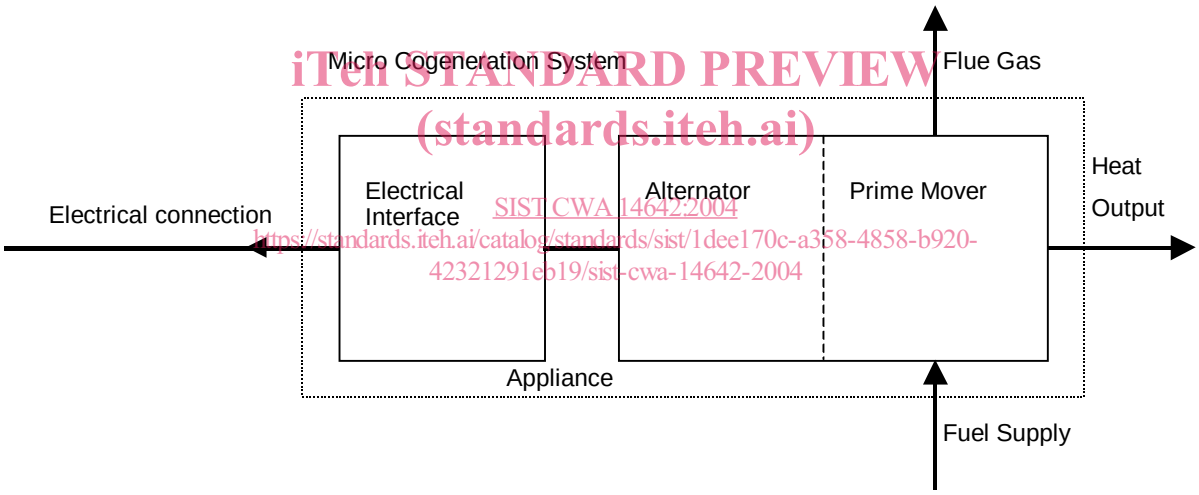

Figure 1:
Micro-cogeneration system (example)

Appliance fault current
The contribution from the appliance to the current flowing to the fault

Automatic reclosing equipment
Automatic equipment that is designed to initiate the reclosing of circuit-breaker(s) after operation of the protection on the associated circuit

Certified appliance
An appliance that meets the product certification requirements

Clearing time
The clearing time is the time between the start of an abnormal condition and the micro-cogeneration unit ceasing to energise the installation or network

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[2] where possible IEC Multilingual Dictionary (on CD) is used

Cogeneration (CHP: combined heat and power)
The generation of electricity by an energy conversion system and the concurrent use of the associated thermal energy from the conversion system as an auxiliary energy source

Commissioning
The process by which a power plant, apparatus, or building is approved for operation based on observed or measured operation that meets design specifications

Contracted person
The person who holds the contract for electricity connection at the house, where the micro-cogeneration appliance is installed

Decommissioning
The process of removing an appliance, apparatus, equipment, building, or facility from operation

Decoupling protection
Comprises all functions including loss of mains protection

Disconnection (automatic)
The automatic disconnection of the supply from the installation, or a discrete section of it

Distribution Network (DN)
The electrical network transporting electricity in medium and low voltages between the transmission network and the connected customer

Distribution Network Operator (DNO)
The company responsible for operating, maintaining, managing connections and investing in the distribution network

Earth fault
The occurrence of a conductive path between a live conductor and the Earth

Domestic electrical installation
An assembly of electrical equipment that is used inside the domestic premises for the distribution and/or use of electric energy except the cogeneration appliance itself (fuse – meter - switchboard – installation)

The following diagram is for illustration only

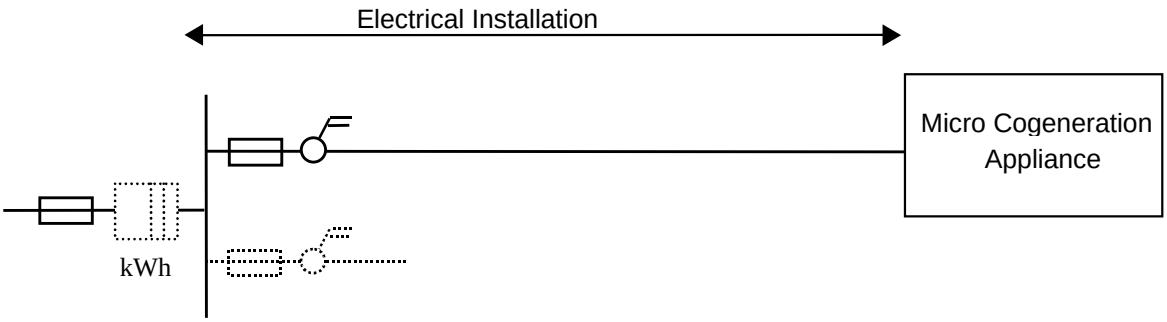

Figure 2:
Domestic electrical installation together with the micro-cogeneration appliance (example).

Electrical interface
Those parts of a cogeneration unit's software and hardware that interact with the electrical installation and network through the terminals of the unit

Electricity exports
The electric energy generated in an electrical installation and flowing to the distribution network

Electricity supply system
All installations and plants provided for the purpose of generating, transmitting and distributing electricity

Fuel cell
An electrochemical device that converts chemical energy directly into heat and electricity

Gas engine
An internal combustion engine modified or specifically designed to run on gaseous fuel

Generating unit
A device for transforming mechanical, thermal or chemical energy into electricity

Installation (of the appliance)
The placement and connection of a micro-cogeneration appliance

Internal Combustion Engine
An engine in which combustion of the fuel takes place in a confined space, providing expanding gases that are used directly to provide mechanical power

Inverter
A static converter for the conversion of direct current to alternating current

Island (in a power system)
A portion of a power system, that is disconnected from the remainder of the system, but remains energized

Islanding, intended
This occurs when the installation is operated intentionally to supply electricity to the consumer when the network is temporarily unavailable

Islanding, unintended
This occurs when the network fails and the unit continues to operate in a grid connected manner

Islanding (network splitting)
The process whereby a power system is split into two or more islands

NOTE :– Islanding is either a deliberate emergency measure, or the result of automatic protection or control action, or the result of human error

Isolation
The disconnection of all phases and neutral from an apparatus for safety and accessibility reasons. Once the appliance has been isolated and shut down it can be safely accessed

Kinematic Stirling Engines
In this design of engine, the piston(s) are driven through connecting rods and a crankshaft, swash plate or other means. [Stirling Engines Colin D West]

Labelling
The use of appropriate safety notices and information on the appliance and other relevant places

Linear electric generator
A linear motion electromagnetic device that transforms short-stoke oscillatory motion mechanical energy into single-phase ac electrical energy