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Solar energy systems for roofs - Requirements for structural connections to solar panels

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Solar energy systems for roofs - Requirements for structural connections to solar panels

Systèmes d'énergie solaire pour les toits : Exigences relatives aux raccordements des panneaux solaires à la charpente

Solare Energiesysteme für Dächer: Anforderungen an konstruktive Verbindungen zu Sonnenkollektoren

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European foreword

This document (CEN/TR 16999:2019) has been prepared by Technical Committee CEN/TC 128 “Roof covering products for discontinuous laying and products for wall cladding”, the secretariat of which is held by NBN in co-operation with CEN/TC250 “Structural Eurocodes”, CEN/TC254 “Flexible sheets for waterproofing”; CEN/TC312 “Thermal solar systems and components” and CLC/TC82 “Solar photovoltaic energy systems”.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

Introduction

The following is a summary of the requirements for structural design of the structural connection between solar energy panels and the roof structure as detailed in this Technical Report.

a) Type of solar panel: Thermal or photovoltaic solar panels which comply with the mechanical resistance requirements of EN 12975-1 (solar thermal collectors) or EN 61215 (solar PV panels).

b) Determining of the loads and load combinations: self-weight of the solar panels and relevant imposed snow and wind actions in accordance with EN 1991-1-1, EN 1991-1-3 and EN 1991-1-4. Referring to French Standard NF P78−116 and Dutch Standard NEN 7250 for additional data on snow and wind loads on solar panels.

c) Determining the design loads for the solar panels: multiplication of each of the loads by their respective partial factor γ_G or γ_Q for the ultimate limit state, and separately for the serviceability limit state in accordance with EN 1990.

d) Identifying combinations of most unfavourable design loads which act together at the same time, for the ultimate and serviceability limit states. Modifying the loads by applying a load combination factor ψ to one of the two variable loads which act at the same time.

e) Determining of the structural resistance of the connections between the solar panels and the roof structure in accordance with calculation methods of one or more of the following European Standards:

   EN 1992 series to EN 1996 series, and EN 1999 series for the ultimate and serviceability limit states:

   1) For the serviceability limit state, determining of the resistance at the specified maximum deformation limiting the function of the connection;

   or

   2) determine the resistance by serviceability and ultimate load tests.

f) Verifying the design by confirming that the factored structural resistance is not less than the critical combinations of factored actions for both limit states.

Four examples of design calculations for different solar panel connections are given in Annex A.

1 Scope

This document provides guidance on the principles and requirements of structural design for the safety and serviceability of the structural connection between solar energy panels (thermal or photovoltaic) and the structure of flat or pitched roofs.

This document does not include requirements for:

— weather tightness of the roof, solar panels and connections;

— electrical, thermal or mechanical characteristics of the solar panels;

— precautions against fire of the installation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 1990:2002, *Eurocode - Basis of structural design*[1)]

EN 1991-1-1, *Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings*

EN 1991-1-3:2003, *Eurocode 1 - Actions on structures - Part 1-3: General actions - Snow loads*

EN 1991-1-4:2005, *Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions*

EN 1992 (all parts), *Eurocode 2 - Design of concrete structures*

EN 1993 (all parts), *Eurocode 3 - Design of steel structures*

EN 1994 (all parts), *Eurocode 4 - Design of composite steel and concrete structures*

EN 1995 (all parts), *Eurocode 5 - Design of timber structures*

EN 1996 (all parts), *Eurocode 6 - Design of masonry structures*

EN 1998-1:2004, *Eurocode 8: Design of structures for earthquake resistance - Part 1: General rules, seismic actions and rules for buildings*[2)]

EN 1998 (all parts), *Eurocode 8: Design of structures for earthquake resistance*

EN 1999 (all parts), *Eurocode 9: Design of aluminium structures*

EN 1999-1-1:2007, *Eurocode 9: Design of aluminium structures - Part 1-1: General structural rules*[3)]

1) This document is impacted by the amendment EN 1990:2002/A1:2005.

2) This document is impacted by the amendment EN 1998-1:2004/A1:2013.

3) This document is impacted by the amendments EN 1999-1-1:2007/A1:2009 and EN 1999-1-1:2007/A2:2013.