Recommendations for renewable energy and hybrid systems for rural electrification –
Part 3: Project development and management
CONTENTS

FOREWORD ........................................................................................................................................... 5

INTRODUCTION ........................................................................................................................................ 7

1 Scope .................................................................................................................................................. 8

2 Normative references ......................................................................................................................... 8

3 Terms and definitions .......................................................................................................................... 10

4 Responsibilities of the participants .................................................................................................. 11

4.1 Overview .......................................................................................................................................... 11

4.2 General specification ....................................................................................................................... 14

5 Contractual relationship between participants ................................................................................. 14

5.1 Overview .......................................................................................................................................... 14

5.2 Notion of contract ............................................................................................................................. 14

5.3 Contractual commitments ................................................................................................................. 15

5.3.1 Contract between the project developer and the project implementer ........................................ 15

5.3.2 Contract between the project implementer and subcontractors .................................................. 15

5.3.3 Contract between the owner and the operator ............................................................................. 16

5.3.4 Contract between the operator and the user ............................................................................... 16

5.3.5 Contract between the owner and the project developer ............................................................... 16

5.3.6 Contract between the owner and the user ............................................................................... 16

5.3.7 Contract between the project developer and the engineering consultant .................................. 16

5.3.8 Contract between the project developer and the training provider ........................................... 17

5.4 Contractual commitment verification procedures ........................................................................... 17

5.5 Consequences of non-adherence to the commitments ..................................................................... 17

5.6 Technical considerations ................................................................................................................. 17

5.7 Documentation .................................................................................................................................. 18

5.7.1 General .......................................................................................................................................... 18

5.7.2 Project implementation documentation ....................................................................................... 18

5.8 Operational/technician documentation ............................................................................................ 18

5.8.1 General .......................................................................................................................................... 18

5.8.2 System installation manual ........................................................................................................... 18

5.8.3 Users’ basic operation manual ..................................................................................................... 19

6 Relevant tests for renewable energy electrification systems ............................................................ 20

6.1 Purpose ............................................................................................................................................ 20

6.2 References to standards ................................................................................................................... 21

6.3 Conditions of environment ............................................................................................................... 21

6.3.1 General .......................................................................................................................................... 21

6.3.2 Climatological/environmental conditions ................................................................................... 21

6.3.3 Environmental conditions affecting equipment service life ......................................................... 21

6.4 Tests .................................................................................................................................................. 22

6.4.1 General .......................................................................................................................................... 22

6.4.2 General information on tests ........................................................................................................ 24

6.4.3 Safety tests ..................................................................................................................................... 24

6.4.4 Climatological and mechanical tests ............................................................................................ 27

6.4.5 Electromagnetic compatibility tests (EMC tests) ....................................................................... 34

7 Minimum quality assurance provisions for project implementation .................................................. 37

7.1 Purpose ............................................................................................................................................. 37
7.2 Quality assurance targets ............................................................... 37
7.3 Quality assurance basic principles .................................................. 38
7.4 Quality assurance phases and participants ..................................... 39
7.4.1 Implementing a quality assurance procedure .................................. 39
7.4.2 Certification of components .......................................................... 39
7.4.3 Design and construction quality assurance ....................................... 39
7.4.4 Maintenance quality assurance ...................................................... 40
7.4.5 Independent verification ............................................................... 40
7.4.6 Processing failures and complaints ................................................. 40
7.5 Procedures ..................................................................................... 40
7.6 Quality plan .................................................................................. 40
7.6.1 General ...................................................................................... 40
7.6.2 Operation context ................................................................. 41
7.6.3 Traceability and archiving of quality assurance actions .................. 41
7.6.4 Organization of the operation ...................................................... 41
7.6.5 Quality assurance implementing supervisors ................................. 42
8 Protection of the environment, recycling and decommissioning .......... 43
8.1 Purpose ....................................................................................... 43
8.2 Protection of environment .............................................................. 43
8.3 Recycling process and decommissioning ........................................... 43
8.3.1 Recycling components .............................................................. 43
8.3.2 Decommissioning ................................................................. 44
Annex A (informative) Technical considerations on contractual liabilities between project participants .......................... 45
A.1 Technical guarantees ....................................................................... 45
A.2 Sizing ....................................................................................... 45
A.3 Design .................................................................................... 45
A.4 Procurement items ........................................................................ 45
A.5 Installation ................................................................................. 46
A.6 System commissioning ............................................................... 46
A.7 Operator or technician training ....................................................... 46
A.8 User training syllabus ................................................................. 47
A.9 Contractual warranty .................................................................... 47
A.10 Maintenance contract ............................................................... 47
A.11 Replacement of components ....................................................... 48
A.12 Maintenance organization .......................................................... 48

Figure 1 – Contractual relationship between project participants ........... 15
Figure 2 – Verification of operation of differential current device ............. 27
Figure 3 – Distribution of the impacts of an impact test ............................ 29
Figure 4 – Layout for overturning test .................................................... 32

Table 1 – Responsibilities of the different participants .......................... 13
Table 2 – List of tests ......................................................................... 23
Table 3 – List of tests ......................................................................... 29
Table 4 – Analysis of the requirements and definition of quality targets .... 41
Table 5 – Analysis of risks .................................................................. 41
Table 6 – Sequence of actions and corresponding results..........................................................41
Table 7 – Quality assurance implementing supervisors.............................................................42
INTERNATIONAL ELECTROTECHNICAL COMMISSION

RECOMMENDATIONS FOR RENEWABLE ENERGY AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –

Part 3: Project development and management

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.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

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

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62257-3, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.
This second edition cancels and replaces the first edition issued in 2004. It constitutes a technical revision.

The main technical changes with regard to the previous edition are as follows:

- redefine the maximum AC voltage from 500 V to 1 000 V, the maximum DC voltage from 750 V to 1 500 V;
- removal of the limitation of 100 kVA system size. Hence the removal of the word “small” in the title and related references in this technical specification.

This technical specification is to be used in conjunction with the latest editions of the IEC 62257 series.

The text of this technical specification is based on the following documents:

<table>
<thead>
<tr>
<th>Enquiry draft</th>
<th>Report on voting</th>
</tr>
</thead>
<tbody>
<tr>
<td>82/948/DTS</td>
<td>82/999A/RVC</td>
</tr>
</tbody>
</table>

Full information on the voting for the approval of this technical specification 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.

A list of all parts in the IEC 62257 series, published under the general title *Recommendations for renewable energy and hybrid systems for rural electrification*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.
INTRODUCTION

The IEC 62257 series intends to provide to different players involved in rural electrification projects (such as project implementers, project contractors, project supervisors, installers, etc.) documents for the setting up of renewable energy and hybrid systems with AC voltage below 1 000 V and DC voltage below 1 500 V.

These documents are recommendations:

- to choose the right system for the right place;
- to design the system;
- to operate and maintain the system.

These documents are focused only on rural electrification concentrating on, but not specific to, developing countries. They should not be considered as all-inclusive to rural electrification. The documents try to promote the use of renewable energies in rural electrification; they do not deal with clean mechanism developments at this time (CO₂ emission, carbon credit, etc.). Further developments in this field could be introduced in future steps.

This consistent set of documents is best considered as a whole with different parts corresponding to items for safety, sustainability of systems aiming at the lowest life-cycle cost as possible. One of the main objectives is to provide the minimum sufficient requirements, relevant to the field of application, that is, renewable energy and hybrid off-grid systems.

The purpose of this part of the IEC 62257 series is to propose a framework for project development and management and includes recommended information that should be taken into consideration during all the steps of the electrification project.
1 Scope

This part of IEC 62257 provides information on the responsibilities involved in the implementation of rural power systems.

In Clause 5, this technical specification presents contractual relationships to be built between the different participants to a project. Throughout the project, responsibilities are to be clearly defined and contractual commitments controlled.

Clause 6 provides relevant tests to be applied to renewable energy and hybrid electrification systems.

Clause 7 provides proposed quality assurance principles to be implemented.

In Clause 8, requirements are proposed for recycling and protection of the environment.

In Annex A of this technical specification, further technical considerations for contractual liabilities are provided.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-2, High-voltage test techniques – Part 2: Measuring systems

IEC 60068-1, Environmental testing – Part 1: General and guidance

IEC 60068-2-1, Environmental testing – Part 2-1: Tests – Test A: Cold

IEC 60068-2-2, Environmental testing – Part 2-2: Tests – Test B: Dry heat

IEC 60068-2-5, Environmental testing – Part 2-5: Tests – Test Sa: Simulated solar radiation at ground level and guidance for solar radiation testing

IEC 60068-2-6, Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)


IEC 60068-2-30, Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*


IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60076-10, *Power transformers – Part 10: Determination of sound levels*


IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-12, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials*

IEC 60721-1, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC 60721-2-1, *Classification of environmental conditions – Part 2-1: Environmental conditions appearing in nature – Temperature and humidity*

IEC 60721-3-1, *Classification of environmental conditions – Part 3-1: Classification of groups of environmental parameters and their severities – Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3-2: Classification of groups of environmental parameters and their severities – Transportation*

IEC 60721-3-3, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weatherprotected locations*

IEC 60721-3-4, *Classification of environmental conditions – Part 3-4: Classification of groups of environmental parameters and their severities – Stationary use at non-weatherprotected locations*

IEC 61000-2-2, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC 61000-3-5, *Electromagnetic compatibility (EMC) – Part 3-5: Limits – Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated current greater than 75 A*

IEC 61000-4-1, *Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques – Overview of IEC 61000-4 series*

IEC 61000-4-2, *Electromagnetic compatibility – Part 4-2: Testing and measuring techniques – Electrostatic discharge immunity test*
IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61180-1, *High-voltage test techniques for low-voltage equipment – Part 1: Definitions, test and procedure requirements*

IEC TS 62257-2, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 2: From requirements to a range of electrification systems*

IEC TS 62257-5, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 5: Protection against electrical hazards*

IEC TS 62257-6, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 6: Acceptance, operation, maintenance and replacement*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

ISO 14000 (all parts), *Environmental management*