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Recommendations for renewable energy and hybrid systems for rural electrification –
Part 10: Silicon solar module visual inspection guide

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CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope 7
2 Normative references 7
3 Terms, definitions, symbols and abbreviated terms 8
3.1 Clarification of terminology 8
3.2 Clarification of severity rating 8
4 Recommendations 9
4.1 General 9
4.2 Inspection procedure 9
4.3 Accept / reject criteria 10
Annex A (normative) Checklists 11
Annex B (normative) Catalogue of defects: new modules 13
B.1 LABEL 13
B.1.1 Missing 13
B.1.2 Poorly attached 13
B.1.3 Information is missing 14
B.1.4 Incorrect spelling 14
B.2 BACKSHEET 15
B.2.1 Delamination 15
B.3 JUNCTION BOX 16
B.3.1 Faulty electrical connection 16
B.3.2 Cracks/breaks/gaps in housing 16
B.3.3 Sealant failure 17
B.3.4 Electrical polarity not indicated 17
B.4 WIRING 18
B.4.1 Wire(s) missing or insecurely attached 18
B.4.2 Too short and/or too thin 18
B.5 FRAME 19
B.5.1 Damaged 19
B.5.2 Adhesive/Sealant failure 19
B.6 FRONT GLASS 20
B.6.1 Cracking 20
B.6.2 Scratches 20
B.7 ENCAPSULATION 21
B.7.1 Delamination 21
B.8 CELLS 22
B.8.1 Fake 22
B.8.2 Dummy pieces disguising missing material 22
B.8.3 Cracks 23
B.8.4 Partially covered 23
B.8.5 Scratches 24
B.8.6 Differently sized 24
B.8.7 Edge chips 24
B.8.8 All cells very shiny 25
B.9 CELL METALLIZATION 26

B.9.1 Fingers not connected to busbar 26
B.9.2 Not the same pattern on all cells 26
B.9.3 Fingers off of edge of corner of cells 27
B.10 CELL INTERCONNECTION 27
B.10.1 Interconnection is discontinuous 27
B.10.2 Cells connected in parallel (counterfeit) 28
B.10.3 Poorly aligned and/or soldered 28
B.10.4 Cells connected in parallel (real cells) 28
Annex C (normative) Catalogue of defects: used modules 29
C.2 BACKSHEET 29
C.2.1. Burn marks 29
C.2.2. Discolouration 29
C.4 WIRING 30
C.4.1 Cracks or exposed metal 30
C.7 ENCAPSULATION 30
C.7.2 Discolouration 30
C.8. CELLS 31
C.8.9 “Snail trails” 31
C.8.10 Shiny locally/significantly varying colour 31
Bibliography 32

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RECOMMENDATIONS FOR RENEWABLE ENERGY AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –

Part 10: Silicon solar module visual inspection guide

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The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
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A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document is organized into a terminology section and a checklist, followed by a table cataloguing and describing the defects to be visually inspected. The schematics in the terminology section describe where each component is found on a common solar PV module. A severity rating is also defined to give users guidelines on how concerning a particular defect may be. In the checklist and the catalogue of defects, defects have been organized by the component of the module on which they appear, followed by severity rating. The order in which components are inspected goes from the back to the front of the module, following a procedure developed elsewhere [3][1]. The catalogue of defects is subdivided into two sections: the first referring to defects that might be found on new modules, and the second describing defects that might appear over time. This document is principally focused on defects that are observable at the beginning of product life. Selected significant defects that may appear over time are also included for completeness and to address the second-hand market.

This document was developed as a response to observations of sub-standard quality and counterfeit solar products present in developing world markets. Many consumers and retailers are not aware of the presence of significant visually observable defects that may limit performance and/or lead to premature product failure. Nor are they aware that good quality PV modules should last 25 years or more. Note that no amount of visual inspection or electrical product testing can guarantee that a module will perform reliably for 25 years.

Although visual inspection cannot catch all possible defects, it can be used as a screening method to identify poor performing products and potential early failure modes. This document was designed with the intention of being a quick tool that is inexpensive to implement, as it does not require any test equipment. Although helpful, no prior knowledge of solar photovoltaics is required to benefit from this guide, and an inspector should be able to be trained in its use in two days or less.

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1 Numbers in square brackets refer to the Bibliography.

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1 Scope

This document is designed to be used as a guide to visually inspect front-contact poly-crystalline and mono-crystalline silicon solar photovoltaic (PV) modules for major defects (less common types of PV modules such as back-contact silicon cells or thin film technologies are not covered herein). The modules under consideration may be of any size or rated power, however some specific use-cases for solar modules may have different requirements and therefore adaption of this document is application and institution dependent (ex. labelling may not be present for a solar module sold as part of a small off-grid lighting kit). This document is meant to supplement and support rather than replace international testing standards (for example IEC 61215 or UL 1703 [1], [2]). A lack of visually observable defects is necessary but not sufficient to determine if a module would pass IEC 61215 testing.

Several applications could be envisioned for this document, including use by:

- border agents to inspect product shipments at ports of entry to a country. Standardized rejection criteria could be used as grounds for barring defective products for import in conjunction with an adopted IEC standard such as IEC 61215;
- standards agencies or regulatory authorities in search and seizure efforts. A tool that can be used onsite to determine if defective or fraudulent products are found for sale in markets;
- retailers/distributors to ensure they are receiving acceptable quality products from manufacturers;
- installers/technicians when selecting product from retailers or distributors for customers;
- educators as a teaching tool for students of solar energy, for example when training technicians;
- inspectors of already installed solar products to catalogue defects and attempt to trouble-shoot failures.

However, as this guide deals primarily with new modules, alternative tools are recommended for this task (see for example [3]).

2 Normative references

There are no normative references in this document.