

TECHNICAL SPECIFICATION



Recommendations for renewable energy and hybrid systems for rural electrification –
Part 9-5: Integrated systems – ~~Selection of stand-alone lighting kits~~ Laboratory evaluation of stand-alone renewable energy products for rural electrification

[IEC TS 62257-9-5:2018](https://standards.iteh.ai/catalog/standards/iec/5effe121-e7e5-48b6-af83-d2901f00d5fe/iec-ts-62257-9-5-2018)

<https://standards.iteh.ai/catalog/standards/iec/5effe121-e7e5-48b6-af83-d2901f00d5fe/iec-ts-62257-9-5-2018>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

[IEC TS 62257-9-5:2018](https://standards.iteh.ai/catalog/standards/iec/5eff121-e7e5-48b6-af83-d2901f00d5fe/iec-ts-62257-9-5-2018)

<https://standards.iteh.ai/catalog/standards/iec/5eff121-e7e5-48b6-af83-d2901f00d5fe/iec-ts-62257-9-5-2018>



TECHNICAL SPECIFICATION



Recommendations for renewable energy and hybrid systems for rural electrification –
Part 9-5: Integrated systems – **Selection of stand-alone lighting kits** Laboratory evaluation of stand-alone renewable energy products for rural electrification

[IEC TS 62257-9-5:2018](https://standards.iteh.ai/catalog/standards/iec/5effe121-e7e5-48b6-af83-d2901f00d5fe/iec-ts-62257-9-5-2018)

<https://standards.iteh.ai/catalog/standards/iec/5effe121-e7e5-48b6-af83-d2901f00d5fe/iec-ts-62257-9-5-2018>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.160

ISBN 978-2-8322-5821-7

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	15
INTRODUCTION.....	18
1 Scope.....	20
2 Normative references	20
3 Terms and definitions	22
4 System limits Product components and characteristics	27
4.1 Components	27
4.1.1 Overview	27
4.1.2 Component categories.....	28
4.1.3 Lighting parts definitions.....	30
4.1.4 Appliance definitions.....	31
4.1.5 Additional system elements	32
4.2 System measurements and observations	32
4.2.1 General	32
4.2.2 Product design, manufacture, and marketing aspects	33
4.2.3 Product durability and workmanship aspects.....	36
4.2.4 Lighting durability aspects	39
4.2.5 Battery performance aspects	40
4.2.6 Solar module aspects	41
4.2.7 Electrical characteristics.....	42
4.2.8 Performance aspects	43
4.2.9 Light output aspects	46
4.2.10 Battery charging circuit efficiency	47
4.2.10 Self-certification aspects.....	47
4.3 Constructions not specifically covered	48
5 Product specification	48
5.1 General.....	48
5.2 Applications	49
5.3 Quality assurance principles	49
5.4 Product specification framework description.....	49
5.4.1 General	49
5.4.2 Product specification template	50
5.4.3 Tolerances	53
5.4.4 Quality standards criteria.....	54
5.4.5 Warranty requirements criteria.....	59
6 Quality test method	60
6.1 General.....	60
6.2 Applications	60
6.3 Sampling requirements	60
6.4 Laboratory requirements	61
6.5 Testing requirements	61
6.6 Recommended tests programme.....	71
6.6.1 General	71
6.6.2 Test preparation	74
6.6.3 Batch A tests	74
6.6.4 Batch B tests	77

6.6.5	Batch C – potentially destructive tests	77
6.6.6	Report preparation.....	78
6.7	Reporting.....	78
7	Market check method	79
7.1	General.....	79
7.2	Applications	79
7.3	Sampling requirements	80
7.4	Laboratory requirements	80
7.5	Testing requirements	80
7.6	Recommended tests programme.....	81
7.7	Report requirements	81
8	Initial screening method.....	81
8.1	General.....	81
8.2	Applications	81
8.3	Sampling requirements	82
8.4	Laboratory requirements	82
8.5	Testing requirements	82
8.6	Recommended tests programme.....	85
8.7	Reporting.....	85
9	Accelerated verification method.....	86
9.1	General.....	86
9.2	Applications.....	86
9.3	Sampling requirements	87
9.3.1	General	87
9.3.2	Verification entry testing	87
9.3.3	Follow-up QTM testing.....	88
9.4	Laboratory requirements	88
9.5	Testing requirements	88
9.5.1	General	88
9.5.2	Verification entry testing	88
9.5.3	Follow-up QTM testing.....	91
9.6	Recommended tests programme.....	92
9.7	Report requirements	92
<hr/> Standardized specification sheets.....		
General.....		
Applications.....		
General.....		
Guidance.....		
Framework for SSS guidelines document.....		
10	Pay-as-you-go (PAYG) method.....	97
10.1	General.....	97
10.2	Applications	98
10.3	Sampling requirements	98
10.4	Laboratory requirements	98
10.5	Testing requirements	98
10.6	Recommended tests programme.....	100
10.7	Reporting.....	100

Annex A (informative) Recommended quality standards for off-grid lighting market support programme qualification Reserved	101
Annex B (informative) Reserved	105
Annex C (informative) Recommended SSS guidelines Reserved	106
Annex D (normative) Manufacturer self-reported information.....	115
D.1 Background	115
D.2 Outcomes	115
D.3 Solicited information	115
D.3.1 General	115
D.3.2 Confidential information (not released publicly).....	115
D.3.3 Public information (may be released publicly)	117
D.4 Reporting.....	119
Annex E (normative) Product sampling	121
E.1 Background	121
E.2 Test outcomes	121
E.3 Related tests	121
E.4 Procedure	121
E.4.1 Retail sampling.....	121
E.4.2 Warehouse sampling	122
E.5 Reporting.....	123
Annex F (normative) Visual screening.....	125
F.1 Background	125
F.2 Test outcomes	125
F.3 Related tests	125
F.4 Procedure	125
F.4.1 Properties, features, and information	125
F.4.2 Specifications	131
F.4.3 Functionality and internal inspection	133
F.5 Reporting.....	136
Annex G (normative) Sample preparation	141
G.1 Background	141
G.2 Test outcomes	141
G.3 Related tests	141
G.4 Procedure	141
G.4.1 General	141
G.4.2 Equipment requirements.....	141
G.4.3 Test prerequisites.....	142
G.4.4 Procedure.....	142
G.4.5 Calculations.....	145
G.5 Reporting.....	145
Annex H (normative) Power supply setup procedure	146
H.1 Background	146
H.2 Test outcomes	146
H.3 Related tests	146
H.4 Equipment requirements	146
H.5 Setup procedure for photometric measurements and lumen maintenance tests	147
H.5.1 Test setup	147

H.5.2	DC voltage and current levels	148
H.5.3	Stabilization period	149
H.5.4	4-wire power supply measurements	149
H.5.5	Filtering electronic noise	150
H.5.6	Troubleshooting	150
H.6	Reporting	153
Annex I (normative)	Light output test	154
I.1	Background	154
I.2	Test outcomes	154
I.3	Related tests	154
I.4	Luminous flux measurement techniques	155
I.4.1	General	155
I.4.2	Calculation for lighting appliances tested according to IEC TS 62257-12-1	156
I.4.3	Luminous flux measurements with an integrating sphere or goniophotometer	156
I.4.4	Luminous flux measurements using the multi-plane method	156
I.5	Correlated colour temperature (CCT) measurement	159
I.6	Colour rendering index (CRI) measurement	159
I.7	Reporting	159
Annex J (normative)	Lumen maintenance test	161
J.1	Background	161
J.2	Test outcomes	161
J.3	Related tests	162
J.4	Procedure	162
J.4.1	General	162
J.4.2	Equipment requirements	166
J.4.3	Test prerequisites	166
J.4.4	Test methods	166
J.5	Calculations	169
J.6	Alternate method for testing lumen maintenance using IESNA LM-80-08	169
J.6.1	Background	169
J.6.2	Equipment requirements	170
J.6.3	Test prerequisites	170
J.6.4	Procedure	170
J.6.5	DUT preparation and LED thermocouple attachment guidelines	171
J.6.6	Calculations	171
J.7	Reporting	172
Annex K (normative)	Battery test	174
K.1	Background	174
K.2	Test outcomes	174
K.3	Related tests	174
K.4	Procedure	174
K.4.1	General	174
K.4.2	Valve-regulated Lead-acid battery test	175
K.4.3	Nickel-metal hydride battery test	178
K.4.4	Lithium-ion battery test	180
K.4.5	Lithium iron phosphate battery test	181

K.5	Reporting	182
Annex L (informative)	Battery testing recommended practices	184
L.1	Background	184
L.2	Deep discharge protection specifications by battery type	184
L.3	Overcharge protection specifications by battery type	185
Annex M (normative)	Full-battery run time test.....	186
M.1	Background	186
M.2	Test outcomes	187
M.3	Related tests	188
M.4	Equipment requirements	189
M.5	Test prerequisites	189
M.6	Apparatus	189
M.7	Procedure	190
M.8	Calculations	197
M.9	Reporting	200
Annex N (normative)	Full discharge preparation.....	202
N.1	Background	202
N.2	Test outcomes	202
N.3	Related tests	202
N.4	Procedure	202
N.4.1	General	202
N.4.2	Equipment requirements.....	202
N.4.3	Test prerequisites	203
N.4.4	Procedure.....	203
N.4.5	Calculations.....	205
N.5	Reporting	205
Annex O (normative)	Grid charge test.....	206
O.1	Background	206
O.2	Test outcomes	206
O.3	Related tests	206
O.4	Procedure	206
O.4.1	General	206
O.4.2	Equipment requirements.....	206
O.4.3	Test prerequisites	207
O.4.4	Apparatus.....	207
O.4.5	Procedure.....	207
O.4.6	Calculations.....	207
O.5	Reporting	208
Annex P (normative)	Electromechanical charge test	209
P.1	Background	209
P.2	Test outcomes	209
P.3	Related tests	209
P.4	Procedure	209
P.4.1	General	209
P.4.2	Equipment requirements.....	209
P.4.3	Test prerequisites	210
P.4.4	Apparatus.....	210
P.4.5	Procedure.....	210

ITeH Standards

<https://standards.iteh.ai/>

Document Preview

IEC TS 62257-9-5:2018

<https://standards.iteh.ai/catalog/standards/iec/5effe121-e7e5-48b6-af83-d2901f00d5fe/iec-ts-62257-9-5-2018>

P.4.6	Calculations.....	210
P.4.7	Modifications for atypical products.....	210
P.5	Reporting.....	211
Annex Q (normative)	Photovoltaic module I-V characteristics test.....	212
Q.1	Background.....	212
Q.2	Test outcomes.....	212
Q.3	Related tests.....	213
Q.4	Procedure.....	213
Q.4.1	Testing using IEC 61215 (all parts) Substitution of IEC 61215-2 test results.....	213
Q.4.2	Test programme using a solar simulator.....	214
Q.4.3	Outdoor photovoltaic module I-V characteristics test.....	216
Q.5	Reporting.....	221
Annex R (normative)	Solar charge test.....	223
R.1	Background.....	223
R.2	Test outcomes.....	223
R.3	Related tests.....	224
R.4	Procedure.....	224
R.4.1	General.....	224
R.4.2	Test method using a resistor network.....	224
R.4.3	Test method using a solar array simulator (SAS).....	231
R.4.4	Calculations.....	232
R.4.5	Alternative method to measure battery-charging circuit efficiency.....	240
R.5	Reporting.....	242
Annex S (normative)	Charge controller behaviour test.....	245
S.1	Background.....	245
S.2	Test outcomes.....	245
S.3	Related tests.....	246
S.4	Procedure.....	247
S.4.1	Active deep discharge protection test.....	247
S.4.2	Active overcharge protection test.....	248
S.4.3	Passive deep discharge protection test.....	253
S.4.4	Passive overcharge protection test.....	255
S.4.5	Standby loss measurement.....	257
S.5	Reporting.....	258
Annex T (normative)	Light distribution test.....	260
T.1	Background.....	260
T.2	Test outcomes.....	260
T.3	Related tests.....	261
T.4	Substitution of results from IEC TS 62257-12-1.....	261
T.5	Approved test methods.....	261
T.5.1	General.....	261
T.5.2	Goniophotometer.....	265
T.5.3	Multi-plane method.....	265
T.5.4	Illuminance on a plane method.....	270
T.5.5	Turntable method.....	273
T.5.6	Illuminance on a desktop method.....	275
T.6	Reporting.....	277
Annex U (normative)	Physical and water ingress protection test.....	281

U.1	Background	281
U.2	Test outcomes	281
U.3	Related tests	282
U.4	Procedure	282
U.4.1	General	282
U.4.2	IP testing at a laboratory that has been accredited to test according to IEC 60529	282
U.4.3	Simplified IP inspection for ingress of solid foreign objects	283
U.4.4	Simplified IP preliminary inspection for ingress of water with harmful effects	284
U.5	Reporting	287
Annex V (normative)	Level of water protection	288
V.1	Background	288
V.2	Test outcomes	288
V.3	Related tests	289
V.4	Laboratory requirements	289
V.5	Procedure	289
V.5.1	General	289
V.5.2	Level of water protection for enclosure only	290
V.5.3	Level of water protection from technical aspects	290
V.5.4	Overall level of water protection	293
V.6	Reporting	294
Annex W (normative)	Mechanical durability test	296
W.1	Background	296
W.2	Test outcomes	296
W.3	Related tests	297
W.4	Procedures	297
W.4.1	Drop test	297
W.4.2	Switch and connector test	299
W.4.3	Gooseneck and moving part test	300
W.4.4	Strain relief test	301
W.5	Reporting	303
Annex X (informative)	Reserved	305
Annex Y (informative)	Photometer box for relative luminous flux measurements	306
Y.1	Background	306
Y.2	Plans	307
Y.3	Instructions for construction	310
Annex Z (informative)	Photometer tube for relative luminous flux measurements Reserved	311
Annex AA (informative)	Field testing method Reserved	313
Annex BB (normative)	Battery durability test	319
BB.1	Background	319
BB.2	Test outcomes	319
BB.3	Related tests	319
BB.4	Procedure	319
BB.4.1	Durability storage test for valve-regulated lead-acid batteries	319
BB.4.2	Durability storage test for flooded lead-acid batteries	320
BB.4.3	Durability storage test for nickel-metal hydride batteries	321
BB.4.4	Durability storage test for lithium-ion batteries	322

BB.4.5	Durability storage test for lithium iron phosphate batteries	323
BB.5	Reporting	324
Annex CC (normative)	Equipment requirements	325
CC.1	Overview	325
CC.2	Requirements and recommendations for equipment and materials	325
CC.3	Guidelines for electrical power measurements	341
CC.3.1	Background	341
CC.3.2	Overview of DC power measurement	341
CC.3.3	Power measurement accuracy recommendations	343
CC.3.4	Additional guidelines and corrective measures	344
Annex DD (normative)	Protection tests	345
DD.1	Background	345
DD.2	Test outcomes	345
DD.3	Related tests	346
DD.4	Procedure	346
DD.4.1	Miswiring protection test	346
DD.4.2	Output overload protection test	349
DD.4.3	PV overvoltage protection test	352
DD.5	Reporting	357
Annex EE (normative)	Assessment of DC ports	360
EE.1	Background	360
EE.2	Test outcomes	360
EE.3	Related tests	361
EE.4	Procedure	361
EE.4.1	Preparation	361
EE.4.2	Measurement of steady-state port characteristics	363
EE.4.3	Dynamic measurement	373
EE.4.4	Summary calculations	378
EE.4.5	Pass/fail tests for functionality and truth in advertising	379
EE.5	Reporting	383
Annex FF (normative)	Appliance tests	385
FF.1	Background	385
FF.2	Appliance testing requirements	385
FF.3	Test outcomes	387
FF.4	Related tests	388
FF.5	Setup and determination of appliance operating voltage	388
FF.5.1	General	388
FF.5.2	Procedure using the power control unit	389
FF.5.3	Procedure using a power supply	390
FF.6	Power consumption test	391
FF.6.1	General	391
FF.6.2	General equipment requirements	391
FF.6.3	Procedure for appliances that have been previously tested according to a recognized test method	391
FF.6.4	Test procedure for LED or CFL lighting appliances without an internal battery	399
FF.6.5	Test procedure for television sets without internal batteries	401
FF.6.6	Test procedure for radios without internal batteries	401

FF.6.7	Test procedure for fans, motor-driven appliances, and other appliances without internal batteries.....	403
FF.6.8	Test procedure for appliances with an internal battery	404
FF.7	Charging efficiency test	405
FF.7.1	General	405
FF.7.2	Equipment requirements.....	405
FF.7.3	Test prerequisites	406
FF.7.4	Procedure.....	406
FF.7.5	Calculations.....	406
FF.8	Appliance operating voltage range test	407
FF.8.1	General	407
FF.8.2	Equipment requirements.....	407
FF.8.3	Test prerequisites	407
FF.8.4	Simultaneous testing for multiple products and applicability of previous test results.....	408
FF.8.5	Procedure for appliances without batteries that have been tested according to a recognized test method.....	408
FF.8.6	Procedure for appliances without an internal battery.....	411
FF.8.7	Procedure for appliances with internal batteries.....	411
FF.9	Appliance full-battery run time test with deep discharge protection measurement.....	412
FF.9.1	General	412
FF.9.2	Equipment requirements.....	412
FF.9.3	Test prerequisites.....	413
FF.9.4	Apparatus.....	413
FF.9.5	Procedure.....	414
FF.9.6	Calculations.....	416
FF.10	Reporting.....	417
Annex GG (normative)	Energy service calculations.....	419
GG.1	Background	419
GG.2	Test outcomes	420
GG.3	Related tests	422
GG.4	Procedure	422
GG.4.1	Full-battery run time energy service calculations	422
GG.4.2	Solar run time energy service calculations.....	439
GG.4.3	Grid or electromechanical run time energy service calculations	463
GG.4.4	Solar charging time calculation	463
GG.5	Reporting	465
Annex HH (normative)	Generic appliances.....	467
HH.1	Background	467
HH.2	Test outcomes	467
HH.3	Related tests	467
HH.4	Equipment requirements	467
HH.5	Procedures	468
HH.5.1	Constructing generic appliances	468
HH.5.2	Appliance reference values.....	470
HH.6	Reporting.....	470
Bibliography	471

iTech Standards
<https://standards.itih.ai/>
 Document Preview

<https://standards.itih.ai/standards/iec-ts-62257-9-5-2018>

Figure 1 – Fixed indoor components and PV module – Example	29
Figure 2 – Fixed outdoor components with an indoor light point – Example	29
Figure 3 – Portable separate components – Example	30
Figure 4 – Portable integrated components – Example	30
Figure 5 – Division of a lighting kit product into subsystems – Illustrative example.....	31
Figure 6 – Recommended sequence of testing for QTM for products without ports.....	72
Figure 7 – Recommended sequence of testing for QTM for products with ports	73
Figure G.1 – Connections with secondary set of wires to avoid battery disconnection	145
Figure H.1 – Power supply setup for powering a power control unit.....	147
Figure H.2 – Power supply setup for directly powering an appliance	147
Figure H.3 – 4-wire test configuration with input filter capacitors.....	150
Figure I.1 – Conceptual schematic of the light output test setup, including the 11 × 11 grid, Cartesian coordinate axes for rotation reference, and the DUT	158
Figure J.1 – Example lumen maintenance plot.....	173
Figure M.1 – Interior view of photometer box with suspended light.....	190
Figure M.2 – Plot of example results for a product with lighting appliances	198
Figure Q.1 – PV module I-V curve testing rack.....	217
Figure R.1 – Schematic of the power supply and DUT connection for the solar charge efficiency test	226
Figure R.2 – Example "true" and simulated I-V curves plotted with the deviation ratio.....	230
Figure R.3 – Example plots of current vs. time for four different DUT batteries	234
Figure R.4 – Example time series plot of the solar charging cycle showing the maximum power available from the PV simulator, actual power supplied by the PV simulator, and power delivered to the batteries	243
Figure R.5 – Example time series plot of the solar charging cycle showing the instantaneous battery-charging circuit efficiency and solar operation efficiency	244
Figure S.1 – Schematic of the DC power supply-DUT connection using a series protection resistor.....	250
Figure T.1 – Horizontal plane for determining FWHM angle and radial illuminance distribution, for an omnidirectional light point.....	263
Figure T.2 – Horizontal plane for determining FWHM angle and radial illuminance distribution, for a directed light point	264
Figure T.3 – Radial illuminance distributions in the horizontal plane for two example DUTs products, showing the calculation of the horizontal FWHM angle.....	269
Figure T.4 – Radial illuminance distribution in the vertical plane for an example omnidirectional ambient light with vertical FWHM = 108°	270
Figure T.5 – Schematic of a task light suspended above an illuminance meter.....	271
Figure T.6 – Schematic of turntable setup, with the DUT shown.....	274
Figure T.7 – Side view of desktop light measuring setup.....	276
Figure T.8 – Example plot of usable area as a function of minimum illuminance.....	278
Figure T.9 – Example of resulting surface plot of light distribution from the brightest "face" of the multi-plane method or illuminance on a plane method	279
Figure T.10 – Example of resulting a polar plot of the radial illuminance from the multi-plane or turntable method distribution.....	280
Figure U.1 – Side view of the apparatus for testing a DUT's an external solar module for protection against water ingress	286
Figure W.1 – Three-dimensional Cartesian coordinate system for drop test reference.....	298

Figure W.2 – Cable strain angle (γ) schematics for a PV module junction box (left) and a separate light point (right)	303
Figure Y.1 – Interior view of a completed photometer box	306
Figure Y.2 – Exterior view of completed photometer box	307
Figure Y.3 – Photometer box dimensions	308
Figure Y.4 – Photometer box assembly pieces and list of materials	309
Figure EE.1 – Schematic of the example DUT with DC port and USB port and variable resistors connected for the measurement of steady-state port characteristics	366
Figure EE.2 – Example of the plots of port characteristics	372
Figure EE.3 – Schematic of the DUT with DC port and USB port and variable resistors connected for the dynamic measurement	375
Figure EE.4 – Illustration of stepped current waveform for procedure 2	377
Figure EE.5 – Example time series plot of voltage and current showing a step increase in current and the resulting voltage undershoot	378
Figure EE.6 – Example time series plot of voltage and current showing a step decrease in current and the resulting voltage overshoot	378
Figure EE.7 – Illustration of functionality assessment	381
Figure EE.8 – Typical configuration of USB port data lines	383
Figure EE.9 – Pin configuration of type A receptacle	380
Figure FF.1 – Illustration of calculation of minimum and maximum values of port voltage for the appliance operating voltage range test	410
Figure GG.1 – Conceptual energy flow diagram for energy service estimates	420
Document Preview	
Table 1 – Applications of product specifications	49
Table 2 – Qualification as separate PV module	50
Table 3 – Truth-in-advertising tolerance	51
Table 4 – Safety and durability standards	51
Table 5 – End user support standards	53
Table 6 – End user support requirements	53
Table 7 – Truth-in-advertising criteria for quality standards	55
Table 8 – Remarks on common truth-in-advertising aspects	56
Table 9 – Safety and durability criteria for quality standards	57
Table 10 – Recommended level of water protection by product category	59
Table 11 – End user support criteria for quality standards	59
Table 12 – Criteria for warranty standards	59
Table 13 – Applications of product specifications QTM results	60
Table 14 – QTM testing requirements	63
Table 15 – Applications of MCM results	79
Table 16 – Applications of product specifications ISM results	81
Table 17 – Applications of AVM results	87
Table 18 – Applications of PAYG method results	98
Table 19 – PAYG testing requirements	99
Table D.1 – Manufacturer self-reported information outcomes	115
Table E.1 – Product sampling outcomes	121
Table F.1 – Visual screening test outcomes	125