IEC 62894

Edition 1.1 2016-11

CONSOLIDATED VERSION

colour inside

Photovoltaic inverters – Data sheet and name plate

IEC 62894:2014-12+AMD1:2016-11 CSV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PHOTOVOLTAIC INVERTERS – DATA SHEET AND NAME PLATE

1 Scope

This International Standard describes data sheet and name plate information for photovoltaic inverters in grid parallel operation.

The object of this standard is to provide minimum information required to configure a safe and optimal system with photovoltaic inverters.

In this context, data sheet information is a technical description separate from the photovoltaic inverter. The name plate is a sign of durable construction on or in the photovoltaic inverter. The name plate may be inside the photovoltaic inverter only if the name plate is visible once a door is opened in normal use.

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IEC 62109-1, *Safety of power converters for use in photovoltaic power systems – Part 1: General requirements*

ISO 216, *Writing paper and certain classes of printed matter – Trimmed sizes – A and B series, and indication of machine direction*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Input side (PV generator)

3.1.1
maximum input voltage
V_{dcmax}
allowed maximum voltage at the inverter input

3.1.2
minimum input voltage
V_{dcmin}
minimum input voltage for the inverter to energize the utility grid, independent of mode of operation

3.1.3
start-up input voltage
$V_{dcstart}$
input voltage at which the inverter starts energizing the utility grid

3.1.4
rated input voltage
$V_{dc,r}$
input voltage specified by the manufacturer, to which other data sheet information refers

3.1.5
maximum MPP voltage
V_{mppmax}
maximum voltage at which the inverter can deliver its rated power

3.1.6
minimum MPP voltage
V_{mppmin}
minimum voltage at which the inverter can deliver its rated power

3.1.7
maximum input current
I_{dcmax}
maximum current at which the inverter can operate. If the inverter has multiple MPP inputs, I_{dcmax} is related to each single input

3.1.8
maximum short-circuit DC input current
I_{scmax}
absolute maximum total PV array short circuit current (DC) that the inverter is rated to have connected to its input terminals, under worst-case conditions of ambient temperature, irradiance, etc.

Note 1 to entry: This term is based on the term $I_{sc,\ PV}$ in IEC 62109-1. It refers to the absolute maximum current the DC input to the inverter is designed for under conditions of expected use. This differs from the simple sum of the marked I_{sc} ratings of the connected PV modules, since those markings are based on short-circuit conditions under standard test conditions, and may be exceeded in temperatures or irradiance levels different from the standard levels.

3.1.9
rated input power
$P_{dc,r}$
input power (DC) at rated input voltage and rated power (AC)

3.2 Output side (grid connection)

3.2.1
maximum grid voltage
V_{acmax}
maximum voltage at which the inverter can energize the grid

3.2.2
minimum grid voltage
V_{acmin}
minimum voltage at which the inverter can energize the grid

3.2.3
rated grid voltage
$V_{ac,r}$
utility grid voltage to which other data sheet information refers

3.2.4
maximum output current
I_{acmax}
maximum output current that the inverter can deliver

3.2.5
rated power
$P_{ac,r}$
active power the inverter can deliver in continuous operation

3.2.6
rated frequency
f_r
utility grid frequency at which the inverter performs as specified

3.2.7
maximum frequency
f_{max}
maximum frequency at which the inverter can energize the grid

3.2.8
minimum frequency
f_{min}
minimum frequency at which the inverter can energize the grid

3.2.9
night-time power loss
power loss of the inverter, which is supplied from the public grid, when no solar generator power is present

3.2.10
cosphi$_{ac,r}$
minimum power factor for which the inverter can output the rated active power

3.2.11
nominal operation power factor
power factor operating at nominal power

3.2.12
power factor of operation range
range of power factor for the range operation of the inverter

3.3 Other optional parameters

3.3.1
time to start-up
t_{start}
default start-up delay time of the inverter under normal conditions

3.3.2
rated AC current
$I_{ac,r}$
rated AC current at rated power ($P_{ac,r}$), and rated grid voltage ($V_{ac,r}$)

3.3.3
maximum AC output power
P_{acmax}
maximum continuous active power the inverter can deliver under specified voltage or temperature conditions within the inverter's rated range of operation

Note 1 to entry: The maximum AC output power (P_{acmax}) may differ from rated power ($P_{ac,r}$) if the inverter is capable of delivering additional power under specific conditions, for example at temperatures below the inverter's maximum ambient temperature rating, or within specified DC voltage ranges.

3.3.4
total harmonic distortion
THD
<current> total harmonic distortion measured in the output current at rated power ($P_{ac,r}$), divided by the full rated fundamental current

Note 1 to entry: This definition of "total harmonic distortion" applies to this document only.

3.3.5
maximum efficiency
η_{max}
maximum measured DC to AC efficiency recorded, tested in accordance with IEC 61683

4 Data sheet information

4.1 General

Technical products are usually brought into the market with a documentation providing information to the user regarding the operating conditions and its intended purpose. A data sheet specifies a product to the extent that the contained data could be consulted for planning or dimensioning. The size and organization of the data sheet are left to the manufacturer. It is however recommendable to be limited to a double-side printed on A4 sheet, according to ISO 216, whereby a topic-specific separation is favourable.

The following subclauses define the minimum required information, which should be included on the datasheet for a photovoltaic inverter. Additional information can however be supplied by the manufacturer.

4.2 Short description

In short the characteristics of the inverter are to be described. Special characteristics of the inverters can be mentioned. For better identification of the equipment, its photo or its true design drawing should be included on the data sheet. The internal design of the inverter should be represented in a clear way (e.g. by means of a block diagram). ~~The topology type should be indicated too.~~

4.3 Conformity

The conformity to relevant norms and standards shall be shown in the data sheet.

4.4 Electrical parameters

4.4.1 General

The electrical parameters from 4.4.2 to 4.4.3 are to be regarded as minimum requirement for a professional system integration of an inverter.

4.4.2 The following parameters of the input side shall be indicated:

V_{dcmax}, V_{dcmin}, $V_{dcstart}$ [1)], $V_{dc,r}$, V_{mppmax}, V_{mppmin}, I_{dcmax}, number of independent MPP inputs (if applicable), I_{scmax}, $P_{dc,r}$, ~~P_{dcmax}, t_{start}~~

The maximum voltage of the connected solar generator should be determined in individual cases from the planner. The maximum input voltage of the inverter should not be exceeded at any time.

The specification of maximum and minimum MPP voltage may also be indicated as ranges.

The list of parameters does not include a maximum DC power rating and it is recommended that such a term not be included in product data sheets. This is due to significant inconsistencies in how the term is used, defined, and interpreted. The maximum array size that can be connected to an inverter should be determined by the maximum short-circuit DC input current rating and the maximum input voltage rating.

4.4.3 The following parameters of the output side shall be indicated:

V_{acmax}, V_{acmin}, $V_{ac,r}$, I_{acmax}, $P_{ac,r}$, f_r, f_{min}, f_{max}, $cosphi_{ac,r}$, ~~$I_{ac,r}$, P_{acmax}, THD, η_{max}~~

The power factor should be displayed over the range of power and not only at rated power. Additionally the number of phases to be connected at the output and the number of phases fed in have to be noted.

The specification of the maximum and minimum output voltages and frequencies may be specified in each case as ranges. If only one value is given, the default status at delivery should be used.

4.4.4 The following parameters are not required on the product data sheet, but may be included if considered useful:

t_{start}, $I_{ac,r}$, P_{acmax}, THD, η_{max}

If the parameters P_{acmax}, and η_{max} are included, the product data sheet shall specify:

– the conditions at which the maximum AC output power can be delivered;

– the DC and AC voltage and ambient conditions at which the maximum efficiency is reported, tested in accordance with IEC 61683.

4.5 Characterisation of the operating performance

4.5.1 The indication of the rated power ($P_{ac,r}$) refers to the respective rated values of the connected grid (e.g. 230 V/50 Hz). The rated power is given at the rated input voltage, rated power and the ambient temperature of (25 ± 3) °C. This value shall be obtained after temperature rise test.

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1) The indication of the start-up input voltage is necessary only if the input voltage is used as switching on criterion for the inverter.

NOTE In addition, the ability of the inverter to supply the rated power even at higher ambient temperatures can be stated together with the time the inverter can supply this power (e.g. 40 °C for 2 h or 35 °C unlimited).

4.5.2 Night-time power loss is to be specified, including the internal power source.

4.5.3 The operating efficiency has to be specified in tabular form at least for the three input voltages (V_{mppmax}, $V_{dc,r}$, and V_{mppmin}) and eight output powers (5 %, 10 %, 20 %, 25 %, 30 %, 50 %, 75 %, and 100 %, where these percentages indicate the ratio of $P_{ac}/P_{ac,r}$). A graphical representation is optional (example: Figure 1).

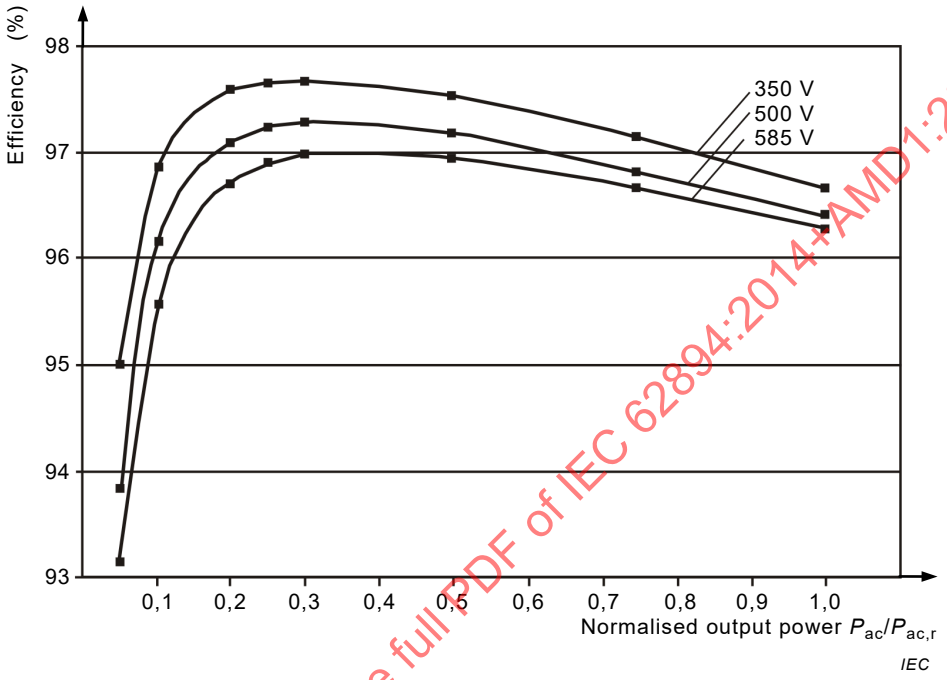

Figure 1 – Representation of the inverter efficiency

4.5.4 For the purpose of self-protection routines can be implemented into the inverter, which prevent a damage (current – power – temperature derating). Any self-protection routine that causes derating shall be described in tabular or graphical form over the entire permitted operation range (see example in Figure 2).

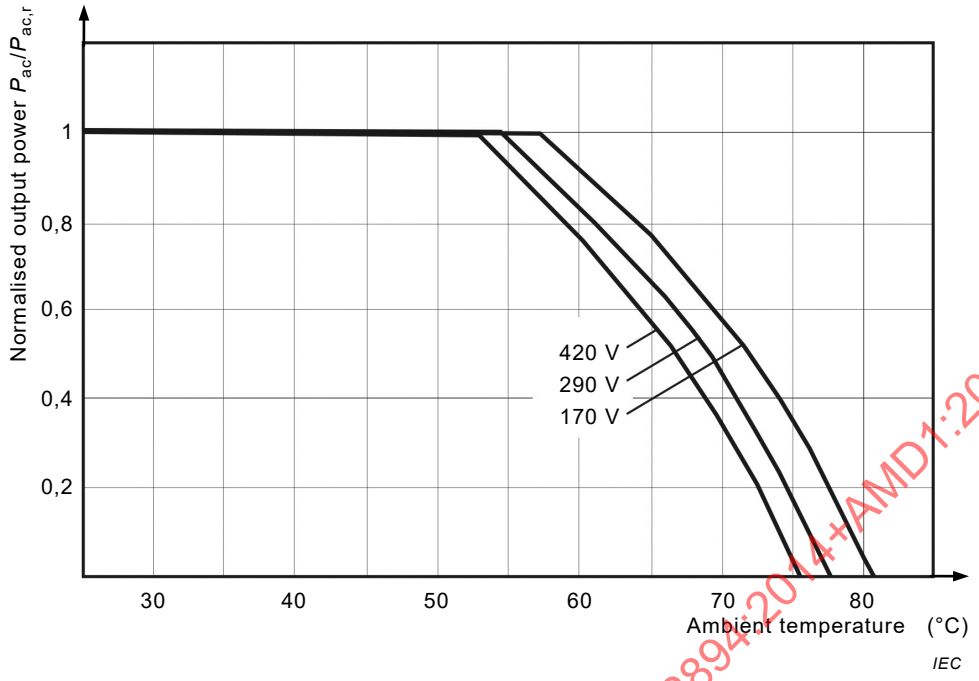

Figure 2 – Power reduction with increased ambient temperatures

4.6 Safety

The following data concerning the safety of inverters shall be contained in the data sheet:

– safety class system according to IEC 62109-1;
– data for galvanic separation (with or without transformer);
– kind of integrated utility interface (indication of the sets of local rules, regulations or laws);
– ~~the method of active detection of loss of mains should be clearly indicated;~~
– ~~time to reconnect after disconnection due to loss of mains should be indicated.~~

Additional information such as the minimum allowed time for an inverter to reconnect to the grid after disconnection due to loss of mains, or the method of active detection of loss of mains, may be included if useful for the particular country or market.

4.7 Operating conditions

The operating conditions for the inverters are differentiated (unprotected in the open, protected in the open, air-conditioned in interiors, without air-condition in interiors).

The degree of severity depends on the use of the inverter and is to be specified by the manufacturer. For inverters to be used in the outdoor the indication of the appropriate climatic class shall be specified according to IEC 60721-2-1 by the manufacturer. Further data concerning the operating conditions of inverters should be contained in the data sheet:

– rated range of the ambient temperature in which the inverter is to be operated may be according to IEC 60721-2-1;
– permissible maximum value for the relative humidity (non-condensing);
– maximum noise emission, to be given if over 75 dB.

4.8 Fitting and construction

4.8.1 Physical characteristics

– Degree of protection according to IEC 60529.

– Overvoltage category according IEC 60664-1.
– Input and output side connection technology.
– Number of input DC connectors (pairs) and number of input DC connectors per MPP input.
– Physical dimensions including protruding parts (width, depth, height).
– Weight.

If applicable the type and manufacturer of the input and output connector should be given.

4.8.2 Other characteristics

– Existing disconnecting device at the input side (if any).
– Cooling principle (convection, forced cooling).
– Name and address of the manufacturer and of market importer, if applicable.
– Communication protocol(s) used should be indicated as well.
– ~~Warranty period should be indicated.~~

5 Details on the name plate

The following list represents the minimum required information, which should be contained on a name plate for a photovoltaic inverter. Additional information can however be supplied by the manufacturer.

The minimum requirements for the production of a name plate are according to IEC 62109-1:

– name and origin of the manufacturer and/or market importer;
– model or type name;
– serial number;
– electrical parameters: V_{dcmax}, V_{mppmin}, V_{mppmax}, I_{dcmax}, $P_{ac,r}$, $V_{ac,r}$, f_r, I_{acmax};
– degree of protection;
– overvoltage category;
– safety class.

Electrical parameters shall be differentiated between input and output values. The arrangement on the name plate should be in such a way that a clear separation is recognizable. The provided data should contain the minimum necessary information, to be able to operate the inverter at a given grid without damage. This shall not substitute the use of the operating instructions.

The name plate (see example in Figure 3) and other inscriptions have to be attached durably on the inverter. ~~The material of the name plate shall be metallic.~~ All inscriptions shall be written in English or in the national language or as understandable, standardized pictograms. The serial number of the product might be located outside of the name plate. In that case the serial number etiquette has to be fully visible around the name plate.

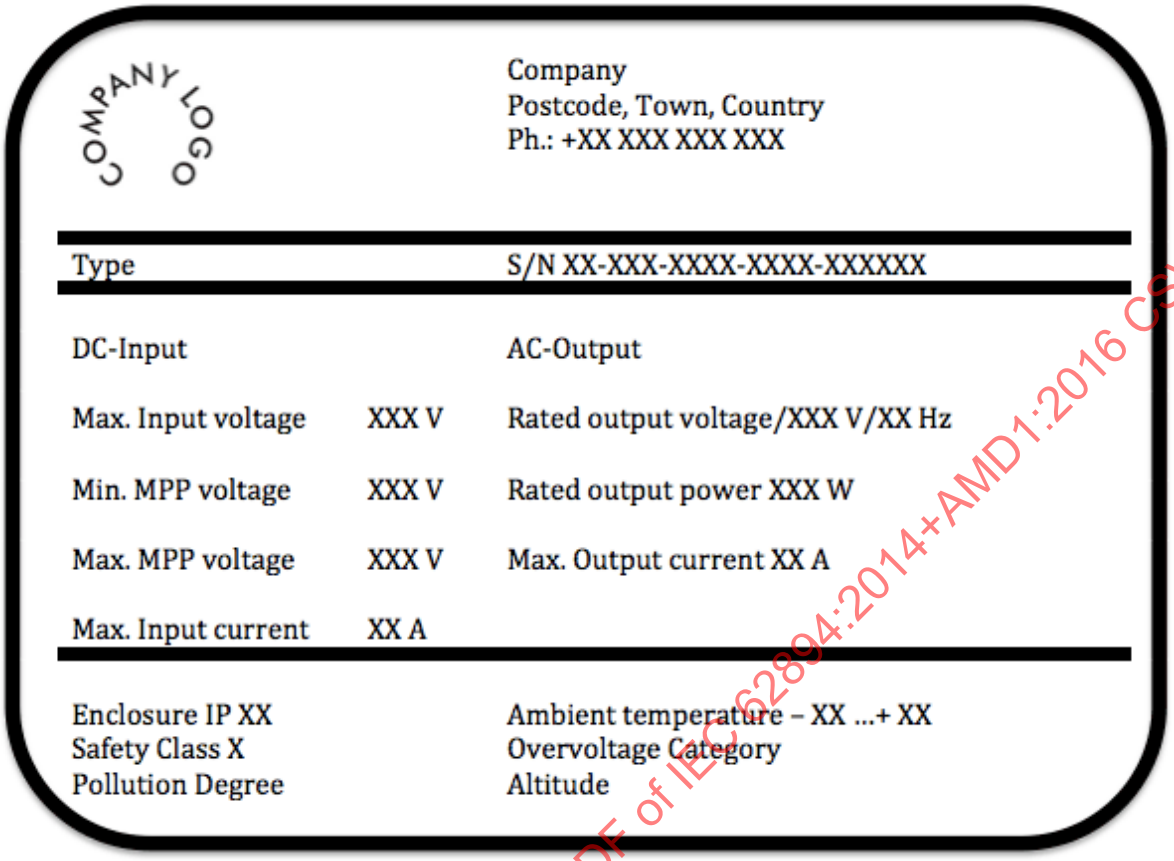

Figure 3 – Example of a name plate

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EN 50438, *Requirements for the connection of micro-generators in parallel with public low-voltage distribution networks*

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maximum grid voltage
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maximum voltage at which the inverter can energize the grid

3.2.2
minimum grid voltage
V_{acmin}
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rated grid voltage
$V_{ac,r}$
utility grid voltage to which other data sheet information refers

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maximum output current
I_{acmax}
maximum output current that the inverter can deliver

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rated power
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active power the inverter can deliver in continuous operation

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rated frequency
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utility grid frequency at which the inverter performs as specified

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maximum frequency
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default start-up delay time of the inverter under normal conditions

3.3.2
rated AC current
$I_{ac,r}$
rated AC current at rated power ($P_{ac,r}$), and rated grid voltage ($V_{ac,r}$)

3.3.3
maximum AC output power
P_{acmax}
maximum continuous active power the inverter can deliver under specified voltage or temperature conditions within the inverter's rated range of operation

Note 1 to entry: The maximum AC output power (P_{acmax}) may differ from rated power ($P_{ac,r}$) if the inverter is capable of delivering additional power under specific conditions, for example at temperatures below the inverter's maximum ambient temperature rating, or within specified DC voltage ranges.

3.3.4
total harmonic distortion
THD
<current> total harmonic distortion measured in the output current at rated power ($P_{ac,r}$), divided by the full rated fundamental current

Note 1 to entry: This definition of "total harmonic distortion" applies to this document only.

3.3.5
maximum efficiency
η_{max}
maximum measured DC to AC efficiency recorded, tested in accordance with IEC 61683

4 Data sheet information

4.1 General

Technical products are usually brought into the market with a documentation providing information to the user regarding the operating conditions and its intended purpose. A data sheet specifies a product to the extent that the contained data could be consulted for planning or dimensioning. The size and organization of the data sheet are left to the manufacturer. It is however recommendable to be limited to a double-side printed on A4 sheet, according to ISO 216, whereby a topic-specific separation is favourable.

The following subclauses define the minimum required information, which should be included on the datasheet for a photovoltaic inverter. Additional information can however be supplied by the manufacturer.

4.2 Short description

In short the characteristics of the inverter are to be described. Special characteristics of the inverters can be mentioned. For better identification of the equipment, its photo or its true design drawing should be included on the data sheet. The internal design of the inverter should be represented in a clear way (e.g. by means of a block diagram).

4.3 Conformity

The conformity to relevant norms and standards shall be shown in the data sheet.

4.4 Electrical parameters

4.4.1 General

The electrical parameters from 4.4.2 to 4.4.3 are to be regarded as minimum requirement for a professional system integration of an inverter.

4.4.2 The following parameters of the input side shall be indicated:

V_{dcmax}, V_{dcmin}, $V_{dcstart}$ [1)], $V_{dc,r}$, V_{mppmax}, V_{mppmin}, I_{dcmax}, number of independent MPP inputs (if applicable), I_{scmax}, $P_{dc,r}$

The maximum voltage of the connected solar generator should be determined in individual cases from the planner. The maximum input voltage of the inverter should not be exceeded at any time.

The specification of maximum and minimum MPP voltage may also be indicated as ranges.

The list of parameters does not include a maximum DC power rating and it is recommended that such a term not be included in product data sheets. This is due to significant inconsistencies in how the term is used, defined, and interpreted. The maximum array size that can be connected to an inverter should be determined by the maximum short-circuit DC input current rating and the maximum input voltage rating.

4.4.3 The following parameters of the output side shall be indicated:

$$V_{acmax},\ V_{acmin},\ V_{ac,r},\ I_{acmax},\ P_{ac,r},\ f_r,\ f_{min},\ f_{max},\ \text{cosphi}_{ac,r}$$

The power factor should be displayed over the range of power and not only at rated power. Additionally the number of phases to be connected at the output and the number of phases fed in have to be noted.

The specification of the maximum and minimum output voltages and frequencies may be specified in each case as ranges. If only one value is given, the default status at delivery should be used.

4.4.4 The following parameters are not required on the product data sheet, but may be included if considered useful:

t_{start}, $I_{ac,r}$, P_{acmax}, THD, η_{max}

If the parameters P_{acmax}, and η_{max} are included, the product data sheet shall specify:

– the conditions at which the maximum AC output power can be delivered;
– the DC and AC voltage and ambient conditions at which the maximum efficiency is reported, tested in accordance with IEC 61683.

4.5 Characterisation of the operating performance

4.5.1 The indication of the rated power ($P_{ac,r}$) refers to the respective rated values of the connected grid (e.g. 230 V/50 Hz). The rated power is given at the rated input voltage, rated power and the ambient temperature of (25 ± 3) °C. This value shall be obtained after temperature rise test.

NOTE In addition, the ability of the inverter to supply the rated power even at higher ambient temperatures can be stated together with the time the inverter can supply this power (e.g. 40 °C for 2 h or 35 °C unlimited).

4.5.2 Night-time power loss is to be specified, including the internal power source.

1) The indication of the start-up input voltage is necessary only if the input voltage is used as switching on criterion for the inverter.