BLUE ANGEL

The German Ecolabel

Photovoltaic Inverters

DE-UZ 163

Basic Award Criteria

Edition January 2012

Version 1

The Environmental Label is supported by the following four institutions:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is the owner of the label. It regularly provides information on the decisions taken by the Environmental Label Jury.

Umwelt Bundesamt

The German Environmental Agency with its specialist department for "Ecodesign, Eco-Labelling and Environmentally friendly Procurement" acts as office of the Environmental Label Jury and develops the technical criteria of the Basic Criteria for Award of the Blue Angel.

Jury Umweltzeichen

The Environmental Label Jury is the independent, decision-making body for the Blue Angel and includes representatives from environmental and consumer associations, trade unions, industry, the trade, crafts, local authorities, academia, the media, churches, young people and the German federal states.

RAL gGmbH

The RAL gGmbH is the awarding body for the Environmental Label. It organises the process for developing the relevant award criteria in independent expert hearings – which involve all relevant interest groups.

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Prolongation without any change for 4 years, until 31.12.2018

Table of Contents

1 Introduction

1.1 Preface

The Environmental Label Jury has set up these Basic Criteria for Award of the Blue Angel Eco-Label in co-operation with the Federal Minister for the Environment, Nature Conservation and Nuclear Safety, Umweltbundesamt (Federal Environmental Agency) and considering the results of expert hearings conducted by RAL gGmbH. RAL gGmbH has been tasked with awarding the Environmental Label.

Upon application to RAL gGmbH and on the basis of a Contract on the Use of the Environmental Label to be concluded with RAL gGmbH the permission to use the Blue Angel eco-label may be granted for all products, provided that they meet the requirements specified hereinafter.

1.2 Background

Within the context of the energy turnaround the German Federal Government aims to meet 35 percent of the electricity demand through renewable energy resources by 2020. Photovoltaics plays a growing role in pursuit of this aim. Even if the number of additional systems will grow at a slower rate in the future the share of photovoltaically generated electric power will continue to grow. Hence, several challenges arise:

- The space available for solar or photovoltaic (PV) installations is limited. Hence, it is important to use the space available as efficiently as possible, i.e. to improve the power-generating efficiency of PV systems. This also means increased revenue for the operator and, thus, increases the incentive of install PV systems.
- The unsteady production of electricity from photovoltaic cells is a challenge for network management and network stability. That is why the systems need to engage in network management.

The quality of photovoltaic or solar inverters is of great importance to both tasks. The efficiency of the inverters is decisive for both the module efficiency and the overall efficiency of the system. Moreover, modern inverters can take over additional tasks in the field of network management, as, for example, provision of reactive power, controlled shutdown in the event of frequency exceedance or remote controllability.

In addition, inverters - just like all power electronic products – contain valuable materials, but they may also contain hazardous substances. The hazardous substance

content and the possible recycling of solar inverters are not yet covered by the RoHS and WEEE directives – from which PV products are exempt. Recycling of inverters is not yet widespread. Hence, there is plenty of room for voluntary initiatives.

And there are other quality aspects, such as low standby consumption and low noise emissions, which are not yet taken into account by all manufacturers, even though some manufacturers have shown that these problems can be technologically solved easily.

Thus, an eco-label for PV inverters can help demonstrate the feasibility of “all around good” products from the environmental point of view, create an incentive for their manufacture and marketing as well as remunerate correspondingly committed manufacturers. Such an eco-label may also serve as preparation for legal initiatives, as for example, the inclusion of PV inverters into the RoHs and WEEE directives.

1.3 Objectives of the Blue Angel Eco-Label

First and foremost, the eco-label identifies PV (or solar) inverters that perform their core functions in a particularly efficient manner, i.e. feature high energy efficiency and engage in network management. In addition, Blue Angel eco-labelled products must feature a long service life, be low-pollutant and recyclable. Other quality criteria are low noise emissions, safety and electromagnetic compatibility.

1.4 Definitions

According to DIN EN 61683 the “no-load loss“ of a PV inverter is the power consumption of an inverter when the system is connected to the public power grid and does not feed power to the grid on the AC side (output power = 0).

2 Scope

These Basic Criteria apply to string and multi-string inverters up to an output power of 13.8 kVA designed for use in grid-connected PV power systems.

Excluded are:

- Modular solar inverters and
- Inverters designed for use in stand-alone systems.

The applicant shall declare in Annex 1 that the product falls within the scope.

3 Requirements

3.1 Energy Efficiency

3.1.1 Overall Efficiency

The systems must have an overall efficiency η_t according to DIN 50530 of at least 95 percent. The overall efficiency is to be determined as follows:

1. Calculation of the static MPPT efficiency ($\eta_{MPPTstat}$) according to DIN EN 50530, Chapter 4.3, on the basis of the voltage levels given in Table 1 and the power levels given in Annex D1 (European Efficiency) taking DIN EN 61683 into account.
2. Calculation of the conversion efficiency η_{conv} according to DIN EN 50530, Chapter 4.5, on the basis of the voltage levels given in Table 2 and the power levels given in Annex D1 (European Efficiency) taking DIN EN 61683 into account.
3. Calculation of the overall efficiency ($\eta_t = \eta_{MPPTstat} * \eta_{conv}$) according to DIN EN 50530, Chapter 5, on the basis of all measurement points listed in 1. and 2. (voltage levels according to Table 1, Chapter 4.3 or Table 2, Chapter 4.5, power levels according to Annex D1 (European Efficiency)).
4. Calculation of the average values of the overall efficiency on the basis of all voltage levels for each power level.
5. European weighting of the average values according to DIN EN 50530, Annex D1.

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract, give the overall efficiency η_t determined and present the relevant measurement protocol (form of Annex 3 to the Contract).

3.1.2 No-Load Loss

The no-load loss shall not exceed 0.5 watts.

The no-load loss of PV inverters with an integrated data interface that can be accessed any time via a data link shall not exceed 5 watts.

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract, give the no-load loss measured and submit the relevant measurement protocols as Annex 4. The no-load loss shall be measured in accordance with DIN EN 61683, Chapt. 7.1.

3.2 Reactive Power Capability

The inverter must be able to provide reactive power in accordance with Application Guideline VDE-AR-N 4105.

Compliance Verification

The applicant shall declare conformity with VDE-AR-N 4105 in Annex 1 to the Contract in relation to the reactive power (VDE-AR-N 4105, Chapter 5.7.5).

3.3 Longevity

3.3.1 Warranty

The applicant shall offer a standard free-of-charge warranty of at least 5 years. Extended warranty options of up to 20 years shall be available at extra charge.

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract and present the corresponding product literature as Annex 5.

3.3.2 Service

The manufacturer shall follow a service concept under which defective systems are repaired or replaced within a maximum of 48 hours. This service shall be free during the period of warranty.

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract and present its service concept on the basis of proper documents as Annex 6.

3.4 Material Requirements

3.4.1 General Requirements for Plastics

The plastics shall not contain any substances with the following properties:

a) Substances that are identified as particularly alarming under the Chemicals Regulation REACH (1907/2006/EC) and which have been incorporated into the list drawn up in accordance with Article 59 (1) of the REACH Regulation (so-called "list of candidates", as amended at the time of application)[1],

b) Substances which according to the criteria of Regulation (EC) No 1272/2008[2] (or Directive 67/548/EEC) are assigned the following H Phrases (R Phrases) or meet the criteria for such classification:[3]

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1 For the list of candidates, as amended, please go to

http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp

2 Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (short: GHS Regulation).

The GHS Regulation (Globally Harmonized System), that has come into force on January 20, 2009, replaces the old Directives 67/548/EEC (Dangerous Substances Directive) and 1999/45/EC (Dangerous Preparations Directive). According to the said regulation, substances are classified, labelled and packed until December 1, 2010 according to Directive 67/548/EEC while mixtures (formerly preparations) are classified, labelled and packed until June 1, 2015 according to Directive 1999/45/EC. Thereafter the GHS Regulation shall be applied. The new indications of danger (H Phrases) as well as the hitherto applicable R Phrases shall be indicated for substances until the 1st of June 2015.

3 The harmonized classifications and labellings of dangerous substances can be found in Part 3 of Annex VI to Regulation (EC) No 1272/2008 (GHS Regulation). Table 3.1 lists classifications and labellings according to the new system using H Phrases; Table 3.2 lists classifications and labellings according to the old system using R Phrases. The GHS Regulation can be found, for example, at: http://www.reach-info.de/ghs_verordnung.htm.

In addition, a comprehensive classification and labelling inventory will be made publicly available on the ECHA website from December 1, 2010 which will also include the manufacturers' self-classifications of hazardous substances.

Toxic Substances:

H300	(R28)	Fatal if swallowed
H301	(R25)	Toxic if swallowed
H304	(R65)	May be fatal if swallowed and enters airways
H310	(R27)	Fatal in contact with skin
H311	(R24)	Toxic in contact with skin
H330	(R26)	Fatal if inhaled
H331	(R23)	Toxic if inhaled
H370	(R39/23/24/25/26/27/28)	Causes damage to organs
H371	(R68/20/21/22)	May cause damage to organs
H372	(R48/25/24/23)	Causes damage to organs
H373	(R48/20/21/22)	May cause damage to organs

Carcinogenic, Mutagenic and Reprotoxic Substances:

H340	(R46)	May cause genetic defects
H341	(R68)	Suspected of causing genetic defects
H350	(R45)	May cause cancer
H350i	(R49)	May cause cancer by inhalation
H351	(R40)	Suspected of causing cancer
H360F	(R60)	May damage fertility
H360D	(R61)	May damage the unborn child
H360FD	(R60/61)	May damage fertility. May damage the unborn child
H360Fd	(R60/63)	May damage fertility. Suspected of damaging the unborn child
H360Df	(R61/62)	May damage the unborn child. Suspected of damaging fertility
H361f	(R62)	Suspected of damaging fertility
H361d	(R63)	Suspected of damaging the unborn child
H361fd	(62/63)	May damage fertility. May damage the unborn child
H362	(R64)	May cause harm to breast-fed children

Water-Hazardous Substances:

H400	(R50)	Very toxic to aquatic life
H410	(R50/53)	Very toxic to aquatic life with long-lasting effects
H411	(R51/53)	Toxic to aquatic life with long-lasting effects

Other Health and Environmental Effects:

EUH059	(R59)	Hazardous to the ozone layer
EUH029	(R29)	Contact with water liberates toxic gas
EUH031	(R31)	Contact with acids liberates toxic gas
EUH032	(R32)	Contact with acids liberates very toxic gas
EUH070	(R39-41)	Toxic by eye contact

Exempt from regulations a) and b) are:

- Substances being present as impurity or addition as an individual constituent below the “cut-off values” according to Article 11 of Regulation (EC) No 1272/2008 or below the concentration limit above which a substance would have to be mentioned in the Material Safety Data Sheet. If Regulation (EC) No 1272/2008 specifies substance-specific limits these limits shall be observed with the respective lower limit value being applicable.
- Homogeneous plastic parts less than 25 grams in mass (as for cables, the 25-gram mass limit refers to the cable plastic only).

Exempt from regulation b) are:

- Monomers or additives that turn into polymers during the manufacture of plastics or are chemically (covalently) bound to the plastic if their residual concentrations are below the classification thresholds for mixtures.

Plastic components of mass greater than 25 grams shall be marked according to the ISO 11469 standard.

Compliance Verification

The applicant shall declare compliance with the requirement in Annex 1 to the Contract, present a list of the marked plastics (form of Annex 7 to the Contract) and submit declarations form the suppliers (e.g. from the suppliers of housings, printed

circuit boards, cables and plugs) stating that the product does not contain the banned substances (form of Annex 2 to the Contract).

3.4.2 Additional Requirements for Plastics used in Housings and Housing Parts

The use of halogenated polymers shall not be permitted. Moreover, halogenated organic compounds may neither be used as additives nor added to the plastic parts.

Exempt from this regulation are:

- Fluoroorganic additives (as, for example, anti-dripping agents) used to improve the physical properties of plastics, provided that they do not exceed 0.5 weight percent.
- Fluoroplastics as, for example, PTFE.
- Plastic parts less than 25 grams in mass.

The flame retardants used in plastic parts of mass equal to or greater than 25 g shall be named and identified by their CAS Registry No.

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract. With regard to the flame retardants, the applicant the applicant shall request the manufacturers or suppliers of plastics to send a written declaration to RAL gGmbH stating that the housing plastics do not contain the banned substances (form of Annex 8 to the Contract). In addition, the applicant undertakes to request the manufacturers or suppliers of housing plastics to confidentially disclose the chemical designation of the flame retardants used (CAS No) to RAL gGmbH (form of Annex 8 to the Contract.

3.4.3 Additional Requirements for Plastics used in Printed Circuit Boards

Neither PBBs (polybrominated biphenyls), nor PBDEs (polybrominated diphenyl ethers), nor TBBPA (tetrabromobisphenol A), nor chlorinated paraffins may be added to the carrier material of the printed circuit boards .

Compliance Verification:

The applicant shall declare compliance with the requirement in Annex 1 to the Contract and submit written declarations from the manufacturers or suppliers of printed circuit boards to RAL gGmbH stating that the printed circuit boards do not contain the banned substances (form of Annex 2 to the Contract).

3.4.4 Requirements for Electronic Components

The electronic components shall not contain lead, mercury, cadmium or hexavalent chromium. Lead-containing solder shall not be used.

Compliance Verification

The applicant shall declare compliance with the requirements and submit a written declaration from the manufacturers or suppliers of electronic components or request the latter to submit such declaration to RAL gGmbH. (form of Annex 9 to the Contract). Alternatively, the applicant may submit a RoHS certificate.

3.5 Recycling and Disposal

3.5.1 Recyclability

(1) PV inverters shall be so designed as to allow easy disassembly for the purpose of recycling. The aim is to separate the fractions of materials (e.g. copper, aluminium, steel, plastics) and to recycle them by type of material.

(2) Blue Angel eco-labelled solar inverters shall be so designed as to support an efficient disassembly by a specialist firm using ordinary tools.

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract and submit detailed instructions for a professional disassembling of the PV inverter (Annex 10). These instructions may be submitted either in writing or by photo, drawing or in video format.

Moreover, the applicant shall undertake in Annex 1 to the Contract to provide recycling companies – on request - with information on efficient disassembling, the individual components and on the substances and components that need to be treated selectively.

3.5.2 Product Take-Back

The manufacturer shall offer free take-back of its product. Thereafter, the manufacturer shall route the used product to reuse, recycling or – should this be impossible – to professional disposal.

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract and present proper documents in proof thereof as Annex 11.

3.6 Safety

(1) The units meet the safety requirements under DIN EN 62109 VDE 0126-14, „Safety of power converters for use in photovoltaic power systems“. This standard defines minimum requirements for protection against electric shock, energy, fire, mechanical and other hazards.

(2) If the inverter features an integrated electronic load break switch the applicant shall submit a certificate of non-objection from the Berufsgenossenschaft der Feinmechanik und Elektrotechnik (BGFE) (German trade association for precision mechanics and electrical engineering), Deutsche Gesellschaft Unfallversicherung e.V. (DGUV) or from a certification body accredited under DIN EN 45011 by a national accreditation agency.

(3) The product literature shall include instructions for integrating the inverter into grounding, potential equalisation and lightning protection systems.

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract and present corresponding certificates (Annex 12 to the Contract) or, for example, the CE Certificate evidencing compliance with the requirements (Annex 13 to the Contract) as well as the relevant product literature (cf. Annex 5, para. 3.3.1).

3.7 Electromagnetic Compatibility

The inverter systems shall conform to DIN EN 61000-6-1; VDE 0839-6-1 (Electromagnetic Compatibility (EMC) - Immunity for residential, commercial and light-industrial environments) and DIN EN 61000-6-3; VDE 0839-6-3 (Electromagnetic compatibility (EMC) - Emission standard for residential, commercial and light-industrial environments)

Compliance Verification

The applicant shall declare compliance with the requirements in Annex 1 to the Contract and present the CE Certificate for the system as Annex 13.

3.8 Noise Emissions

The noise emissions of the systems shall not exceed a maximum sound power level of 55dB (A).

Compliance Verification

The applicant shall declare compliance with the requirement in Annex 1 to the Contract and submit (as Annex 14) a measurement protocol prepared by a DIN EN ISO/IEC 17025 accredited testing laboratory as well as the relevant pages of the product literature as Annex 5 (cf. para. 3.3.1). The sound power level shall be measured and specified according to DIN EN 60704-1 or DIN EN 60704-3.

3.9 Consumer Information

Data sheet and name plate made available to the consumer shall include the minimum information according to DIN EN 50524 (VDE 0126-13) (Data sheet and name plate for photovoltaic inverters). The data sheet details can be seen from Appendix 1: Data Sheet Specifications for PV Inverters“.

Compliance Verification

The applicant shall declare compliance with the requirement in Annex 1 to the Contract and present the data sheet and the name plate as Annex 15.

4 Applicants and Parties Involved

4.1 Manufacturers or distributors of products under para. 2 shall be eligible for application.

4.2 Parties involved in the award process are:

- RAL gGmbH to award the Blue Angel eco-label,
- the federal state being home to applicant’s production site,
- Umweltbundesamt (Federal Environmental Agency) which after the signing of the contract receives all data and documents submitted in application for the Blue Angel in order to be able to further develop the Basic Award Criteria.

5 Use of the Blue Angel Environmental Label

5.1 The terms governing the use of the Environmental Label by the applicant are stipulated by a Contract on the Use of the Environmental Label to be concluded with RAL gGmbH.

5.2 Within the scope of such contract the applicant undertakes to comply with the requirements under paragraph 3 while using the Environmental Label.

5.3 Contracts on the Use of the Environmental Label are concluded to fix the terms for the certification of products under paragraph 2. Such contracts shall run until December 31, 2018. They shall be extended by periods of one year each, unless terminated in writing by March 31, 2018 or March 31 of the respective year of extension.

After the expiry of the contract the Environmental Label may neither be used for labelling nor for advertising purposes. This regulation shall not affect products being still in the market.

5.4 The applicant (manufacturer) shall be entitled to apply to RAL gGmbH for an extension of the right to use the label to the product entitled to the label if it is to be marketed under another brand/trade name and/or other marketing organizations.

5.5 The Contract on the Use of the Environmental Label shall specify:

5.5.1 Applicant (manufacturer/distributor)

5.5.2 Brand / trade name, product designation

5.5.3 Distributor (label user), i.e. the marketing organization under to paragraph 5.4.

Appendix 1: Data Sheet Specifications for PV Inverters

Parameter	Symbol	Unit
Power data *:*		
Rated DC power	$P_{n\,DC}$	W
Maximum DC input power	P_{DCmax}	W
Rated AC power	$P_{n\,AC}$	W
Maximum AC power	P_{ACmax}	W
Partial efficiencies	$\eta\ (U_y, x\%)$	%
Maximum efficiency	$\eta_{max\%}$	%
European efficiency	η_{Euro}	%
Power factor	$\cos \varphi$	
DC start-up power	P_{on}	W
DC shut-down power	P_{off}	W
Standby consumption	$P_{standby}$	W
Night-time consumption	$P_{night\text{-}time}$	W
Voltage:		
Rated DC voltage	$U_{n\,DC}$	V
MPP voltage range	MPPT	V
Maximum DC voltage	U_{DCmax}	V
Shut-down voltage	$U_{DCshut\text{-}down}$	V
AC voltage range		V
Currents:		
Rated DC current	$I_{n\,DC}$	A
Maximum DC current	I_{DCmax}	A
Rated AC current	$I_{n\,AC}$	A
Maximum AC current	I_{ACmax}	A
Distortion factor	k	%
Other:		
Dimensions (H, W, D)		mm
Total weight		kg
Noise level		dB(A)
Temperature range (minimum, maximum)	T_{min}, T_{max}	°C
Efficiency change at T_{max}	$\Delta\ \eta_{Tmax}$	%
Efficiency change in the event of deviations from rated DC voltage	$\Delta\ \eta_U$	%/100 V
Static MPP efficiency (DIN EN 50530)	η_{MPP}	%
Dynamic MPP efficiency (DIN EN 50530)	η_{MPP}	%
Overload behaviour	Description	
Type of network monitoring	Description	
Installation Instructions	Description	
IP protection class according to IEC 60529	Specify:	
Isolation monitoring	Specify:	
Number of MPP trackers	Specify:	

CONTRACT

No

on the Award of the Blue Angel Environmental Label

RAL gGmbH as the label-awarding agency and the firm of

(Distributor)

as applicant conclude the following Contract on the Use of the Environmental Label:

S P E C I M E N

1. Under the following conditions the applicant shall be entitled to use the Environmental Label forming the basis of this Contract for the labelling of the product / product group / project:
   „Photovoltaic Inverters“ for

   "Brand/Trade Name".

   This shall not include the right to use the Environmental Label as part of a brand. Unless otherwise agreed, the Environmental Label shall only be used in the above given shape and colour and shall be marked at the bottom "Jury Umweltzeichen" (Environmental Label Jury). The entire inner surrounding text shall always be identical as regards font size, form, thickness and colour and it shall be easy to read.
2. The Environmental Label according to para. 1 may only be used for the above-mentioned product / product group / project.
3. If the Environmental Label is used for advertising purposes or other applicant activities the applicant shall make sure that it is exclusively used in connection with the above-named product / product group / project for which the use of the Environmental Label has been granted and settled under this contract. The applicant shall be solely responsible for the way the label is used, above all, in advertising.
4. During the entire period of label use the product / product group / project to be labelled shall comply with all requirements and conditions for the use of the label as specified in the "Grundlage für Umweltzeichen-Vergabe RAL-UZ **163**" (Basic Criteria for Award of the Environmental Label RAL-UZ **163**), as amended. This shall also apply to the reproduction of the Environmental Label (including surrounding text). Claims for damages against RAL gGmbH, especially on the grounds of third party objections to applicant's use of the label and the accompanying advertising shall be ruled out.
5. If the "Basic Criteria for Award of the Environmental Label" provide for checks by third parties the applicant shall bear the costs accruing in connection therewith.
6. Should the applicant himself or third parties find out that the applicant does not comply with the conditions as stipulated in paras. 2-5 the applicant shall be liable to inform RAL gGmbH and stop the use of the Environmental Label until the conditions are complied with again. Should the applicant be incapable of restoring the state required for the use of the label immediately or should the applicant seriously offend against this contract RAL gGmbH may, if necessary, withdraw the Environmental Label and prohibit the applicant from using the label any longer. Claims for damages against RAL gGmbH because of the withdrawal of the label shall be ruled out.
7. The Contract on the Use of the Environmental Label may be terminated for good reason.
   Examples of good reasons are:
   - unpaid contributions
   - substantiated risk of injury and death.

   In such case, applicant’s continued use of the Environmental Label shall be prohibited. The applicant shall not be entitled to bring a claim for damages against RAL gGmbH (see above: paragraph 6, sentence 3).
8. The applicant undertakes to pay RAL gGmbH an amount according to the "Entgeltordnung für das Umweltzeichen" (Schedule of Fees for the Environmental Label), as amended, for the period of use.
9. According to the Basic Criteria for Award of the Environmental Label RAL-UZ **163** this contract will run until **December 31, 2018**. It shall be extended by periods of one year each, unless terminated in writing by **March 31, 2018** or by March 31 of the respective year of extension. After the expiry of the contract the Environmental Label may neither be used for labelling nor for advertising purposes. This regulation shall not affect the products being still in the market.
10. Products / projects marked with the Environmental Label and the advertising for these products / projects may reach the consumer only when naming the company of the **(Applicant/Distributor)**.

Sankt Augustin, this ….. day of ……..20..

Place, Date

RAL gGmbH
Management

(Signature of authorized person and company stamp)