



Business Plan for a VDE SPEC Project

Topic:

“Standardisation of the Classification and Performance Evaluation of AFCI Functionalities in Photovoltaic Systems”

(VDE SPEC 90022 V1.0 (en))

Status: (2) Public commenting

Notes:

- Registrations of interest in participation and comments on the business plan of the VDE SPEC project should be submitted **by 2026-08-07** to spec@vde.com. Submissions received after the deadline do not need to be considered. The project group, once constituted, will decide on the incorporation of comments received on time.
- Contributors to this business plan and commenters are kindly requested to disclose any **relevant patent notices** they are aware of and to provide **supporting documentation**.
- Any gender-related terms used in this document apply equally to all genders. The masculine form has been chosen solely for the sake of better readability.

Offenbach am Main, 2026-07-10

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1 Status of the Business Plan

☐ **Internal commenting**

In this phase, the internal commenting of the VDE SPEC project takes place within VDE.

Internally, the project was reported in Compounds & Technology and circulated for commenting with the deadline 2026-06-22. No comments were received.

Responses regarding participation were received from the interested parties listed in 2.3.

☒ **Public commenting**

This business plan serves to inform the public about the planned VDE SPEC project. Interested parties have the opportunity to participate in the project and/or to comment on the business plan. Reporting channels for this purpose are indicated on the title page.

The VDE board decides on the actual execution of the VDE SPEC project after the commenting period has ended.

If the VDE SPEC project goes ahead, all interested parties who have registered for participation or commented on the business plan within the deadline will be invited to the Kick-off.

☐ **Final business plan**

The VDE SPEC will be developed according to this business plan.

Changes compared to the commenting version:

- Table "Organisations that have accepted this business plan" added;
- ... specified

2 Initiator and Members of the Project Group

2.1 Initiator

Person/Organisation	Short description
Patrick Zank VDE SIS GmbH	Patrick Zank is a Senior Consultant and Project Engineer at VDE SIS GmbH, specializing in battery and energy storage systems. He holds a degree in industrial engineering with a focus on materials science. Since joining VDE in 2020, he has led technical due diligence for Battery Energy Storage Systems, supported system-level consulting projects, and co-published studies on battery technologies and alternative propulsion systems. Mr. Zank serves as an expert at DKE, contributing to international electrotechnical standards, and is actively involved in the Battery Passport consortium, helping shape the Digital Product Passport framework under the EU Battery Regulation. In his role in Business Development, Mr. Zank acts as Key Account Manager for international industry partners across the PV, BESS, and grid conformity sectors, fostering strategic collaborations and aligning technical capabilities with market needs. He is also a frequent speaker and trainer at international conferences and industry events, sharing insights on energy storage technologies, quality assurance, regulatory frameworks, and digital product data systems.

2.2 Possible Members of the Project Group

The VDE SPEC will be developed by a project group that is open to all interested parties. The participation of further experts is sensible and welcomed. It is suggested that, for example, the following stakeholders contribute to the work:

- Providers of testing methodologies for AFCI functionality evaluation in photovoltaic systems,
- Manufacturers of PV inverters and AFCI components,
- Test equipment manufacturers,
- Testing laboratories and certification bodies,
- EPC contractors, plant operators, investors, and scientific institutions.

2.3 Kick-off Participants (as of publication of the business plan)

The following experts have already expressed their interest in attending the Kick-off:

Person	Organisation
Stipe Mandic	VDE
Dean Wen	VDE
Wei Lui	Huawei
Cuirong Long	Huawei
Guilei Gu	Huawei
Charlie Cheng	Huawei
Dingpu Liu	TAIER

2.4 Project Group (after Kick-off)

The experts listed below have accepted this business plan and are therefore part of the project group:

Person	Organisation

3 Goal of the Project

3.1 General

With the rapid expansion of photovoltaic (PV) systems, electrical safety, particularly with regard to DC arc faults, has become increasingly critical. Arc Fault Circuit Interrupter (AFCI) functionalities represent a key protection mechanism to detect and mitigate fire risks in PV installations at an early stage.

While international standards such as IEC 63027 define baseline requirements and test procedures for AFCI systems, they primarily focus on minimum performance criteria for detection and interruption, without enabling a differentiated assessment of system performance beyond compliance.

At the same time, recent verification campaigns and field-oriented testing have demonstrated that modern AFCI systems show significant differences in terms of:

- detection accuracy,
- response time,
- robustness against electrical noise and disturbances,
- behaviour under real-world installation conditions.

Structured test campaigns, including extended and non-standard test scenarios, provide valuable insights into AFCI performance beyond existing normative frameworks.

Based on these findings, there is a clear need to translate such results into a standardized methodology for the classification of AFCI functionalities, enabling objective and comparable performance evaluation.

3.2 Intended Scope of Application

Scope

This VDE SPEC defines a methodology for the classification and performance evaluation of AFCI functionalities in photovoltaic systems, based on standardized as well as extended testing approaches.

The objective is to establish a reproducible, transparent, and comparable framework that goes beyond existing standards and enables differentiation of AFCI system performance.

This VDE SPEC does not contain any safety-related specifications and does not define any requirements for the protective function of AFCI devices. All safety-related minimum requirements for the detection and interruption of DC arcs remain unchanged and are exclusively governed by the relevant international standards, in particular IEC 63027 and the IEC 62109 series of standards.

The following aspects are in particular considered:

- **Terminology and Definitions**
 - Definition of arc fault events (series and parallel arcs)
 - Differentiation between real faults and nuisance events
- **Classification of AFCI Functionalities**
 - Definition of performance levels (e.g., detection classes)
 - Categorization based on system behaviour and response
- **Requirements for Test Procedures**
 - Standardized testing according to IEC 63027
 - Extended test scenarios reflecting real-world conditions
 - Variation of:
 - Cable lengths
 - Capacitance to ground
 - Operating voltages
- **Evaluation Criteria**
 - Detection time
 - Arc energy
 - False positive rate
 - System stability and robustness
- **Influence of System Components**
 - Optimizers / MLPE
 - String configurations
 - MPPT architectures
- **Assessment under Realistic Conditions**
 - Degraded system components
 - Electromagnetic interference
 - Field-representative operating scenarios

- **Representation of Results**
 - Classification model (e.g., classes or scoring system)
 - Cross-manufacturer comparability

Benefits

The development of a standardized classification system for AFCI functionalities will significantly improve transparency and comparability within the PV safety technology market.

Key benefits include:

- **For manufacturers**
 - Clear differentiation beyond minimum compliance
 - Structured positioning based on performance levels
- **For investors, EPCs, and system operators**
 - Improved decision-making through comparable safety metrics
 - Increased confidence in system safety performance
- **For certification and regulatory frameworks**
 - Basis for future standardization activities
 - Link between technical test reports and normative requirements
- **For the overall market**
 - Increased safety and reduction of fire risks
 - Promotion of innovation in AFCI technologies

4 Work Programme

4.1 General

Within the scope of this project, a VDE SPEC will be developed in accordance with the established VDE SPEC process (see www.vde.com/spec).

The objective is to create a structured and consensus-based document defining a **standardized methodology for the classification of AFCI functionalities**, building on both existing standards and validated test data.

The VDE SPEC will be developed in English (working language, meetings, and documentation). A German version may be prepared at a later stage if required.

The development process will be based on:

- Existing international standards (e.g., IEC 63027)
- Results from verification campaigns and technical reports
- Contributions from participating industry experts

A public review phase is currently **not planned** but may be introduced depending on project group decisions.

4.2 Work Plan

The project is planned to start with a **Kick-off meeting 2026-08-11**. The total project duration is expected to be approximately **4 months**.

The Kick-off meeting will be held as a web conference and will include:

- Formal constitution of the project group
- Alignment on objectives, scope, and deliverables
- Agreement on working structure and responsibilities
- Initial technical discussion

Following the Kick-off, approximately **8–10 project meetings** will be conducted (mainly as web conferences). These meetings will be used to:

- present and discuss intermediate results,
- align on technical content,
- review and approve draft sections.

Additional working sessions may take place within **dedicated sub-working groups** focusing on specific technical areas.

The development of the VDE SPEC will be structured into the following work packages:

WP1 – Definition of Scope and Terminology

- Alignment on scope boundaries and use cases
- Definition of key terms (e.g., arc fault types, detection criteria)
- Harmonization with existing standards (IEC, DKE)

Deliverable: Agreed terminology and scope definition

WP2 – Analysis of Existing Standards and Test Methodologies

- Review of relevant standards (e.g., IEC 63027)
- Identification of gaps regarding classification and differentiation
- Mapping of standard test requirements vs. extended test scenarios

Deliverable: Gap analysis and requirements baseline

WP3 – Evaluation of Test Data and Performance Indicators

- Analysis of available AFCI verification data (e.g., detection time, arc energy, system response)
- Identification of key performance indicators (KPIs)
- Correlation of test conditions with system performance

(Reference to existing verification campaigns and reports)

Deliverable: Defined set of evaluation metrics and KPIs

WP4 – Development of Classification Methodology

- Definition of classification logic (e.g., performance classes or scoring system)
- Threshold definition for different performance levels
- Consideration of influencing factors (e.g., optimizers, cable length, capacitance)

Deliverable: AFCI classification framework

WP5 – Validation and Application Scenarios

- Application of the classification methodology to real test cases
- Validation of reproducibility and robustness
- Assessment under standard and extended conditions

(Leveraging insights from whitepaper results and extended test scenarios)

Deliverable: Validated classification approach

WP6 – Drafting of the VDE SPEC

- Consolidation of all work results into a structured document
- Internal review and alignment within the project group
- Iterative refinement of content

Deliverable: Draft VDE SPEC

WP7 – Finalization and Approval

- Final review and voting within the project group
- Resolution of comments
- Submission to VDE for formal approval

Deliverable: Final VDE SPEC ready for publication

5 Organisation of the Project Group

The project is subject to the rules laid down in the [Procedure Description](#) (see also www.vde.com/spec). All interested parties and members of the project group are requested to familiarize themselves with the Procedure Description.

The constitution of the project group takes place during the Kick-off. The Kick-off only takes place after the business plan has been published and the execution of the project has been approved by the VDE board. The project group should consist of at least three project group members from different organisations. It is not necessary for the members to represent different interested circles. By accepting the business plan, the interested parties declare their willingness to participate in the project group and thereby formally become project group members with the associated rights and obligations. Kick-off participants who do not accept the business plan do not obtain the status of project group members and are excluded from further decisions of the Kick-off as well as from the further project.

If an organisation (e.g., an association) delegates a non-permanent employee to the project group, this person must be authorized by the organisation and proof must be provided to VDE.

Each project group member is granted one vote. If an organisation delegates several experts to the project group, the organisation has one vote, regardless of the number of delegates. Votes cannot be transferred to other project group members. Decisions are made by simple majority of the votes cast; abstentions are not counted.

The project group that has been formed is generally closed. The existing project group members decide on the admission of additional members.

During the Kick-off, the project group members elect a Project Group Leader. The Project Group Leader leads the project group in terms of content and drives decision-making (votes, resolutions). The Project Group Leader is supported by the VDE Project Manager, with VDE always taking a content-neutral position. In addition, the VDE Project Manager ensures that the procedural and design rules of VDE are observed during the preparation of the VDE SPEC. If the Project Group Leader can no longer carry out this role, the VDE Project Manager will initiate a new election.

The organisation and management of the Kick-off is carried out by the VDE Project Manager in coordination with the initiator. The other project meetings and/or web conferences are organised by the VDE Project Manager in coordination with the Project Group Leader.

If project group members cannot be present for the adoption of the VDE SPEC or the draft, they must be included in the vote via alternative means (e.g., in writing, electronically).

All project group members who voted in favour of the publication of the VDE SPEC or the draft are listed by name with their respective organisation in the foreword as authors. Project group members who voted against the publication of the VDE SPEC or the draft, or who abstained, may not be named in the foreword.

To enable the proper reproduction and distribution of the results of the project, the project group members grant VDE the rights of use to the copyrights arising from the results of the project work. The transfer of the rights of use does not prevent the members of the project group from continuing to use, exploit and further develop their contributed knowledge, experience and findings.

Project group members are requested to inform VDE about relevant patent rights in connection with this VDE SPEC project.

Subsequent changes to the business plan require, in addition to a 2/3 majority of all project group members, the approval of VDE.

6 Resource Planning

Each project group member bears the expenses incurred in the course of the project at its own cost.

If the VDE board approves the execution of the project, the initiator concludes a contract with VDE.

7 Related Activities

The topic of the planned VDE SPEC is so far only insufficiently the subject of a standard. The following thematically related bodies, standards and/or regulations exist that will be considered and, where appropriate, taken into account in the course of the project:

- IEC 63027 – Photovoltaic systems – DC arc detection and interruption
- IEC 62109 (series) – Safety of power converters for use in photovoltaic power systems
- IEC/TC 82 – Solar photovoltaic energy systems

- UL 1699B – Photovoltaic (PV) DC arc-fault circuit protection (relevance to be confirmed)
- [Relevant DKE national mirror committees for PV / arc-fault protection – to be confirmed by initiator]

8 Contact Persons

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9 Appendix: Timeline (preliminary)

The following timeline serves only as general guidance and must always be adapted to the individual project. In particular, the duration of the development phase depends strongly on the requirements and preferences of the initiator.

VDE SPEC Project	2026											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Initiation												
1. Application and review												
2. Drafting of the business plan												
3. Publication of the business plan												
Development phase												
4. Kick-off / Project group constitution												
5. Drafting of the VDE SPEC												
6. Adoption of the VDE SPEC in the project group												
Publication												
7. Review and approval by VDE												
8. Publication of the VDE SPEC												
Milestones												

- K** Kick-off
- M** Project meeting
- W** Web conference
- V** Adoption of the VDE SPEC