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**Datasheet for the decision  
of 23 September 2022**

**Case Number:** T 0477/18 - 3.4.01

**Application Number:** 10712578.3

**Publication Number:** 2411823

**IPC:** G01R31/08, G01R31/12, G01R31/14

**Language of the proceedings:** EN

**Title of invention:**  
DEVICE AND METHOD FOR LOCATING PARTIAL DISCHARGES

**Patent Proprietor:**  
Techimp HQ S.R.L.

**Opponent:**  
Omicron Energy Solutions GmbH

**Headword:**  
Locating partial discharges in an electric apparatus / Techimp

**Relevant legal provisions:**  
EPC Art. 100(b), 83

**Keyword:**  
Grounds for opposition - insufficiency of disclosure (yes)  
evidence for common general knowledge not sufficient

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

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Case Number: T 0477/18 - 3.4.01

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.01**  
**of 23 September 2022**

**Appellant:** Techimp HQ S.R.L.  
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**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 11 January 2018  
revoking European patent No. 2411823 pursuant to  
Article 101(3) (b) EPC.**

**Composition of the Board:**

**Chairman** T. Zinke  
**Members:** P. Fontenay  
D. Rogers

## Summary of Facts and Submissions

- I. The appeal was filed by the appellant/patentee against the decision of the Opposition Division to revoke European patent 2 411 823.
- II. The opposition relied on the grounds that the patent did not disclose the invention in a sufficient manner (Article 100(b) EPC) and on the lack of novelty and/or lack of an inventive step of the claimed subject-matter (Article 100(a) EPC).
- III. In its decision, the Opposition Division held that the ground for opposition raised under Article 100(b) EPC prejudiced the maintenance of the patent as granted and that auxiliary requests 1 to 4 did not meet the requirements of Article 83 EPC. The other grounds for opposition raised by the opponent were not addressed.

Concretely, the Opposition Division held that the patent specification did not contain any definition of the notion of "shape parameter". With regard to documents:

A1: LEMKE E. et al.; "GUIDE FOR PARTIAL DISCHARGE MEASUREMENTS IN COMPLIANCE TO IEC 60270", WG D1.33, CIGRE, pages 1-55, December 1998;

A2: CAVALLINI A. et al.; "A Novel Method to Locate PD in Polymeric Cable Systems Based on Amplitude-Frequency (AF) Map", IEEE Transactions on Dielectrics and Electrical Insulation, IEEE

SERVICE CENTER, PISCATAWAY, NJ, US, vol. 14, no. 3, 1 June 2007, pages 726-734; and

A3: CAVALLINI A. et al. "Advanced PD Inference in On-Field Measurements; Part I: Noise Rejection"; IEEE Transactions on Dielectrics and Electrical Insulation, vol. 12, no. 2, 1 April 2003, pages 216-224;

which had been filed by the patentee, the Opposition Division expressed doubts that the cited documents qualified as evidence for common general knowledge. This applied, in particular, to documents A2 and A3 which were not reference textbooks, but scientific papers. As observed by the Opposition Division, document A1 did also not contain any reference to the term in question, referring, more generally, to the notion of pulse shape.

IV. The appellant/patentee requested, as a main request, that the decision of the Opposition Division be set aside and the patent be maintained as granted. In the alternative, maintenance of the patent according to one of auxiliary requests 1 to 4, filed with the statement of grounds, was requested.

In support of its argumentation, according to which the skilled person would have known about the concepts used throughout the application from its general knowledge, the appellant filed new documents:

A4: BSI Standards publication; "Rotating electrical machines, Part 27-2, On-line partial discharge measurements on the stator winding insulation of

rotating electrical machines"; 31 October 2012;  
PD IEC/TS 60034-27-2 2012; and

A5: IEEE Guide for the Measurement of Partial  
Discharges in AC Electric Machinery; (IEEE Std  
1434™-2014 - Revision of IEEE Std 1434-2000);  
Approved on 3 November 2014;

as further evidence for common general knowledge.

- V. The respondent/opponent requested, as a main request, that the appeal be dismissed. In the case that the Board decided that the conditions of sufficiency of disclosure were met, remittal of the case to the Opposition Division for examination of the other grounds for opposition was requested, as an auxiliary request.

In the substance, the respondent reiterated the view that the patent specification did not allow the skilled person to carry out the claimed invention. The mere indication that the "shape parameter" was correlated to the waveform of the corresponding pulse was not sufficient to identify said parameter on the basis of which partial discharges occurring at a discharge site in an electric apparatus would have been located.

The respondent further requested that late-filed documents A4 and A5 not be admitted into the appeal proceedings.

- VI. Both parties requested oral proceedings in case their respective requests were not accepted.

VII. In a communication pursuant to Article 15(1) RPBA, the parties were informed of the preliminary view of the Board.

The Board essentially concurred with the Opposition Division in its primary finding that the patent specification did not contain any definition of a "shape parameter". It was observed, in this respect, that the description merely specified that a first shape parameter is correlated with the frequency content of the signal and that a second shape parameter is correlated with its duration, as was recited in the independent claims of the patentee's auxiliary requests. In the absence of any such definition in the patent specification, the question of sufficiency boiled down to determine whether common general knowledge indeed provided the skilled person with the required information.

In view of the evidence made available in the form of documents A1, A2 and A3, it had to be established whether said documents qualified as evidence of common general knowledge and whether the skilled person would have found in A2 or A3 sufficient information to identify a "shape parameter" that would meet the requirements of sufficiency in the context of the claimed invention.

The Board further indicated that it intended not to admit new documents A4 and A5 into the proceedings. While acknowledging that both documents qualify as evidence of common general knowledge, it was stressed that they were both published after the filing date of the patent application. The Board also expressed doubts regarding the substance of said documents and their

suitability to provide the required information. There was namely no indication in A4 and A5 that the parameters regarding the equivalent bandwidth and equivalent time length characterising partial discharges (PD) could also be used to recognise homologous PD signals, that is, PD signals received by measuring stations located at different distances from the PD location.

The board was thus not persuaded that the skilled person would have found in any of documents A1, A2, A3, A4 and A5 a definition for a "shape parameter" that would have been adapted to solve the problem addressed by the claimed invention.

- VIII. Oral proceedings were cancelled after that the patentee had announced that they would not attend.
- IX. Neither the appellant/patentee nor the respondent/opponent commented on the communication of the Board.
- X. Claim 1 of the main request (patent as granted) reads:

A method for locating partial discharges occurring at a discharge site (2) in an electric apparatus (3) with elongate geometry, said partial discharges generating corresponding electric pulses (4) propagating in opposite directions along the apparatus (3) from the discharge site (2) when the electrical apparatus (3) is subject to electrical voltage, characterized in that it comprises the following steps:



- detecting (11) the pulses (4) picked up by a first and a second sensor (5, 7), operatively connected to the apparatus (3) in a first and a second detecting station (6, 8) which are spaced out along the apparatus (3), and providing corresponding electric signals representative of the waveform of the pulses (4);
- deriving (15), for each of the signals, at least one shape parameter correlated with the waveform of the corresponding pulse (4);
- assigning (14) to said signals values of a phase parameter representative of the phase of said voltage applied to the electrical apparatus (3) at the instant the signal is detected;
- deriving (16), for said signals, at least one amplitude parameter correlated with the amplitude of the corresponding pulse (4);
- separating (17) the sets of signals detected in each detecting station into respective subsets, so that the signals of each subset have similar shape parameter values;
- identifying (18) the subsets of signals relating to partial discharges and classifying them according to statistical processes based on the values of the amplitude and phase parameters for the signals of each subset considered individually;
- correlating (19) the subsets of signals detected in the first and second detecting stations and similarly classified, within the subsets identified as relating to partial discharges, in order to derive a pair of subsets of signals relating to pulses generated at the same discharge site (2);
- selecting (12), for the pair of correlated subsets, at least one pair of homologous pulses (4) detected in the first and second sensors (5,7),

respectively, in the same time interval which is less than a predetermined value;

- calculating (13) the distance, along the apparatus (3), between the discharge site (2) and the detecting stations (6, 8), based on the selected pair of homologous pulses (4).

Independent claim 9 of the main request (patent as granted) is directed to a device. It reads:

A device for locating partial discharges occurring at a discharge site (2) in an electric apparatus (3) with elongate geometry, said partial discharges generating corresponding electric pulses (4) propagating in opposite directions along the apparatus (3) from the discharge site (2), comprising:

- a first and a second sensor (5,7), operatively connected to the apparatus (3) in a first and a second detecting station (6, 8) which are spaced out along the apparatus (3), for detecting the pulses (4) and generating electric signals representative of the waveform of the pulses (4);

- a processing unit (9) connected to the sensors (5,7) for receiving the signals and having a module for selecting at least one pair of signals, detected in the first and second sensors (5, 7) and representative of a pair of homologous pulses relating to the same partial discharge and propagating in opposite directions along the apparatus (3), and a module for calculating the distance between the discharge site (2) and the detecting stations (6, 8) along the apparatus (3) based on the selected pair of homologous pulses (4),

characterized in that it comprises, combined together:

- a module for deriving, from said signals, at least one shape parameter correlated with the waveform of that signal, an amplitude parameter and a phase parameter representative of the phase of the voltage applied to the electrical apparatus (3) at the instant the signal is detected;
  - a module for separating the sets of signals detected in each of the detecting stations (6, 8) into respective subsets, so that the signals of each subset have similar shape parameter values;
  - a module for identifying the separated subsets of signals relating to partial discharges and configured to statistically process the amplitude and phase parameter values for the signals of each subset processed individually, in order to classify it;
  - a module for correlating the subsets of signals detected in the first detecting station and in the second detecting station and similarly classified, within the subsets identified as relating to partial discharges and similarly classified, and configured to derive a pair of subsets of signals relating to pulses generated at the same discharge site (2);
- said module for selecting the pair of signals relating to the pair of homologous pulses (4) being configured to select from the signals said pair of correlated subsets.

Claim 1 of auxiliary request 1 includes following limitation at the end of the method claim:

wherein a first shape parameter correlated with the frequency content of the signal and a second shape

parameter correlated with the duration of the signal are derived for each of the detected signals, and wherein the separation step (17) comprises incorporating in a single subset all the signals falling within the same region of a reference plane having as its coordinates said first and second shape parameters.

Claim 1 of auxiliary request 2 was modified with regard to claim 1 of auxiliary request 1 in that the step of calculating the distance has been specified. Said step reads (with added features in bold):

- calculating (13) the distance, along the apparatus (3), between the discharge site (2) and the detecting stations (6, 8), based on the selected pair of homologous pulses (4), **wherein the method comprises, before the selection step (12), a step of synchronizing the signals detected in the first sensor (5) and those detected in the second sensor (7), by means of an absolute time reference.**

Claim 1 of auxiliary request 3 was modified with regard to claim 1 of auxiliary request 1 in that the step of calculating the distance has been specified. It reads (with added features in bold):

calculating (13) the distance, along the apparatus (3), between the discharge site (2) and the detecting stations (6, 8), based on the selected pair of homologous pulses (4), **wherein the sensors (5) and (7) are directional type sensors, configured to detect the propagation direction of the pulses (4) along the apparatus (3).**

Claim 1 of auxiliary request 4 was modified with regard to claim 1 of auxiliary request 1 in that the step of calculating the distance has been specified. Said step reads (with added features in bold):

calculating (13) the distance, along the apparatus (3), between the discharge site (2) and the detecting stations (6, 8), based on the selected pair of homologous pulses (4), **wherein the step (13) of calculating the distance of the discharge site (2) from the detecting stations (6, 8) is based on processing the values of an attenuation parameter for the signals of the selected pair of homologous pulses (4), correlated with a quantity that is variable depending on a distance travelled by the pulses (4) from the discharge site (2) to the corresponding detecting station.**

Corresponding amendments were made in the independent device claims of each request where the calculation module was amended to reflect the amendments in the method claims.

## **Reasons for the Decision**

### *Sufficiency of disclosure (Article 100(b) EPC, Article 83 EPC)*

1. Claim 1 of the main request defines a method for locating partial discharges (PD) occurring at a discharge site in an electric apparatus with an elongate geometry. It comprises the step of "deriving for each of the signals, at least one shape parameter correlated with the waveform of the corresponding pulse". Claim 1 of each of the auxiliary requests

contains the further limitation according to which a first and second shape parameter are derived for each of the detected signals, wherein the first shape parameter is correlated with the frequency content of the signal and a second shape parameter is correlated with the duration of the signal. The independent apparatus claim in each auxiliary request contains similar definitions.

2. The patent does not contain any definition of a "shape parameter", merely specifying in paragraph [0086] that a first shape parameter is correlated with the frequency content of the signal and that a second shape parameter is correlated with its duration, as now recited in the independent claims of the auxiliary requests.
3. While the concept of "shape parameter" indeed suggests, as underlined by the patentee, that it defines a parameter representative of the shape of the pulse, this very general definition is not sufficient for the skilled person to carry out the claimed invention.
4. It is observed that this very general statement suggests that any parameter that can be somehow derived from a pulse would be adapted for the claimed purpose. The fact that the amplitude of the pulse would not be sufficient, as acknowledged by the patentee (Minutes of oral proceedings before the Opposition Division, section 5 and 5.1), shows that this is not the case. It is further underlined, in view of the technical problem actually addressed by the invention (cf. paragraphs [0019] to [0034] in the patent specification) regarding the difficulty of reliably identifying partial discharges, that the definition of the shape parameter is indeed essential. The shape parameter constitutes,

in the context of the invention, the key parameter on the basis of which homologous pulses originating from the same partial discharge in the apparatus being measured but received at different locations may be recognised.

5. In the absence of any definition in the patent specification, the skilled person can only rely on common general knowledge in the field of the invention to compensate for the missing information.
6. Said knowledge does not however provide sufficient guidance to define the key parameters defining a "shape parameter" required for locating partial discharges occurring at a discharge site in an electric apparatus with elongate geometry.
7. Document A1, which was filed by the patentee to substantiate common general knowledge, is a guide for engineers. It summarises the state of the art of conventional electrical PD measurements (cf. A1, page 4, last paragraph). While undoubtedly intended for a broad public, there is no evidence that the document was indeed used or considered in the relevant circles as a reference textbook.
8. Similarly, as underlined by the Opposition Division, documents A2 and A3 are scientific papers which cannot, on their own, be considered to provide evidence of common general knowledge.
9. Moreover, while it is acknowledged that A1 refers to documents A2 and A3 (cf. A1, pages 32, 52 and 53), it fails to establish that the notion of "shape parameter" is to be understood in the light of these documents.

10. Concretely, the teaching of A1, in combination with the specific approach disclosed in A2 and A3, is not sufficient to establish that the notion of "shape parameter" as it appears throughout the patent specification and in the claims is indeed related to the notion of "pulse shape" in said documents (A1, page 32, last paragraph; A2, section 3.1 "pulses having different shapes"; A3, sections 3 and 7). In the absence of any clear relationship between the terms in question no conclusion as to the meaning of the notion "shape parameter" can be drawn from said documents.

11. As underlined above, the shape parameter is deemed to provide the basis for a discrimination between PD signals of various origins while allowing the identification of homologous PD signals, that is, signals received at two different locations by two measuring stations but originating from the same partial discharge. In this respect, it is stressed that the claimed method includes the step of:

*correlating the subsets of signals detected in the first and second detecting stations and similarly classified, within the subsets identified as relating to partial discharges, in order to derive a pair of subsets of signals relating to pulses generated at the same discharge site.*

12. Independently of the objections made above, regarding the fact that none of documents A1, A2 and A3 qualifies as evidence for common general knowledge, it is further stressed that the skilled person would have not found in A2 and A3 sufficient information to identify a "shape parameter" that would meet the requirements referred to above. The mapping disclosed in A2 relies on both duration and frequency of the measured signals.



It appears to be adapted to group PD signals originating from the same origin and received at the same location. However, there is no indication in A2 that this type of grouping would also be adaptable to correlate clusters obtained from signals measured at different locations. To the contrary, section 2.1 of A2 suggests that the parameters used for discriminating between clusters, based on duration and frequency of the measured pulse signals, are dependant on the distance traveled by the pulse and would thus not be adapted for the claimed purpose. Energy loss is a function of both distance and frequency while duration is affected by dispersion and thus by the distance.

*New evidence (A4, A5)*

13. The Board concurs with the patentee that documents A4 and A5 may qualify as evidence for common general knowledge. Both documents were published after the filing date of the patent application. While post-published documents may provide evidence of common general knowledge at earlier dates, this is not generally the case. In the absence of further evidence that sections 5.5 in A4 and 7.7 in A5 refer to common general knowledge at the date of filing of the application, A4 (and A5) are not relevant for the issue to be decided.
14. Moreover, while Figure 2 in section 5.5 in A4 indeed supports the view that PD discharges obtained at a certain measuring location can be identified by two parameters (their equivalent bandwidth and equivalent time length), there is no indication in A4 or A5 that these parameters could also be used to recognise homologous PD signals, that is, PD signals received by

measuring stations located at different distances from the PD location. Document A2 (cf. above) suggests, on the contrary, that the mapping based on time duration and frequency content is not able to recognise such signals. It follows that A4 (and A5) are also not more relevant for the issue of sufficiency than any of documents A1, A2 and A3.

15. For these reasons, documents A4 and A5 are not admitted into the proceedings.

### *Conclusion*

16. In the absence of a clear definition for the concept of shape parameter in the patent specification and in view of the fact that the patentee did not provide evidence that the missing information formed part of common general knowledge, the skilled person would have not been in a position to reproduce the claimed subject-matter. Thus, the invention is not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Articles 100(c), 83 EPC). None of the requests on file is allowable.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chair:



H. Jenney

T. Zinke

Decision electronically authenticated