



ELECTRICAL INSTALLATIONS NATIONAL CONGRESS AND EXHIBITION
IZMIR 2023

STAND A07

ACOUSTIC CAMERA SI124

PARTIAL DISCHARGE AND LEAK DETECTION

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AGENDA



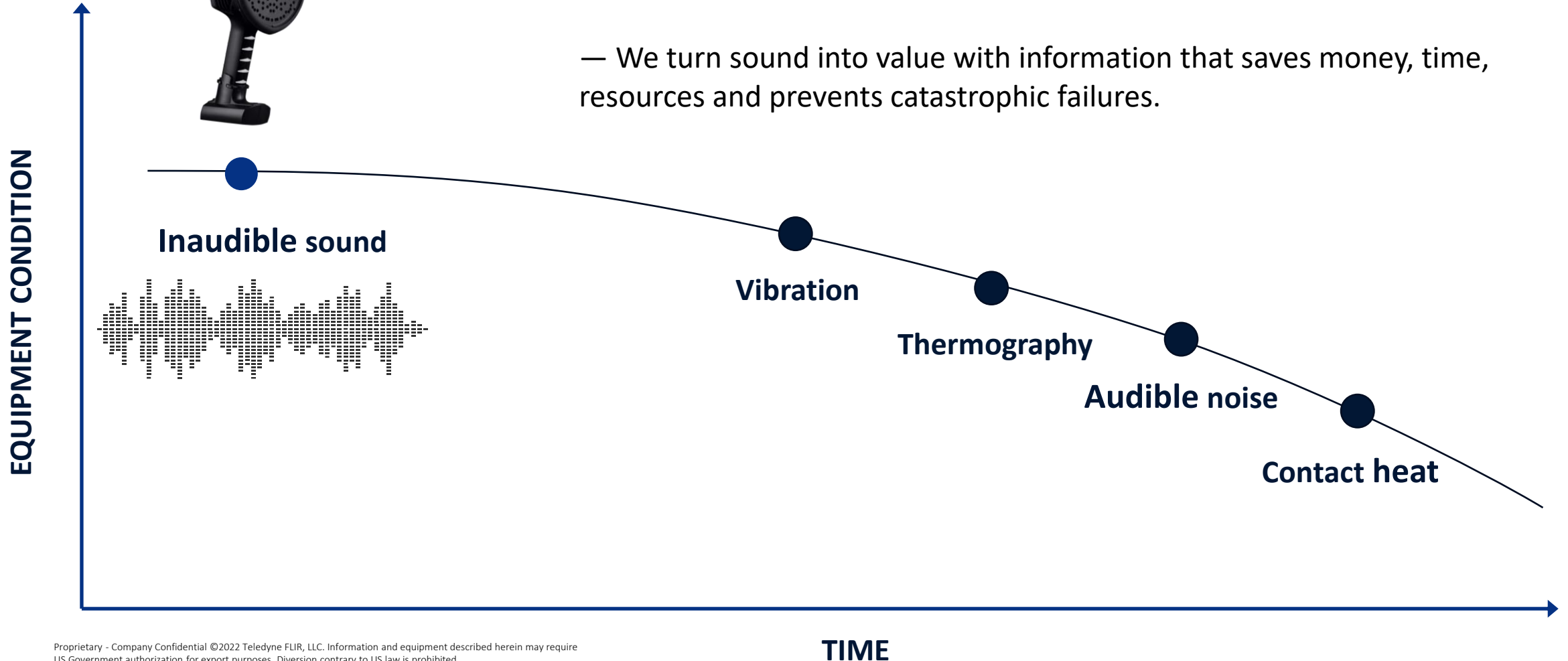
1. About Acoustic Solutions
2. Some customers
3. Si124-PD Acoustic Camera for Partial Discharge Detection
4. Si124-LD Plus Acoustic Camera for Leak Detection
5. Analytics and Software Options

SOUNDS INAUDIBLE TO THE HUMAN EAR



Assets emit a certain type of sound before they begin to break down. Often, these are sounds we cannot hear or cannot locate in noisy environments.

— We turn sound into value with information that saves money, time, resources and prevents catastrophic failures.



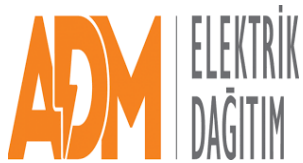
SOME OF OUR CUSTOMERS



Atlas Copco: “The Acoustic Camera saved the users 50% of their time.”

“Included in the Airbus service manual in 2020.”

Petrochemical	Automotive
Pharmaceutical	Labs & Universities
Power Industry	Maintenance
Food Processing	Pulp & Paper
Metals & Mining	Services
Transportation	Avionic



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SI124-PD ACOUSTIC CAMERA FOR PARTIAL DISCHARGE DETECTION

“85% OF DISRUPTIVE FAILURES IN HIGH AND MEDIUM VOLTAGE SYSTEMS ARE RELATED TO PARTIAL DISCHARGES THAT INDICATE A HARMFUL FLOW OF ELECTRICITY.”

“INVISIBLE PARTIAL DISCHARGES IN POWER GRIDS ARE OFTEN THE FIRST INDICATION OF INSULATION FAILURE.”

“PARTIAL DISCHARGES CAUSE POWER LOSS, ELECTROMAGNETIC INTERFERENCE, NOISE COMPLAINTS AND OFTEN PROGRESS OVER TIME LEADING TO CATASTROPHIC FAILURES.”

BENEFITS OF THE SI124-PD



- Prevents expensive downtime and catastrophic failures through early-stage PD detection.
- Scans large areas from a distance and instantly pinpoints critical problems.
- Provides actionable data for maintenance and repairs plans with the help of machine-learning powered analytics.
- Simple to incorporate to the maintenance cycle and requires minimal training.
- Safe and easy to operate using only one hand.

OPERATING THE SI124-PD



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PRACTICAL CONSIDERATIONS TO REMEMBER



- In multi-source mode, the Si124-PD always shows analytics for the strongest sound source, for closer analytics, use single-source mode
- Reflections: if the source moves when moving the camera, it is a reflection
- Hidden sound sources: the camera can show sound sources inside cabinets and other closures when the sound finds its way out
- Filters: the camera's operating distance is greater outdoors where there is rarely high-frequency background noise and where PDs usually occur:
 - Norm (2–30 kHz): The best alternative for all cases with little background noise. Offers the best detection distance.
 - High (20–30 kHz): Offers good detection distance while filtering out most background noise.
 - Ultr (30–65 kHz): Effectively filters out background noise at the expense of reduced detection distance. Only to be used at short distances.

MAIN USE CASES FOR THE SI124-PD



Extremely well suited:

- Early-stage PD detection, location, classification and severity evaluation in air-insulated substations in transmission, distribution, and generation
 - Example use cases: damaged or polluted insulators, bushings, cable ends, broken strands on wires, and installation faults
- Early-stage PD detection, location, classification and severity evaluation in overhead lines in distribution and transmission
- Continuous monitoring of PDs in substations and over-head lines to evaluate their evolution over the time, and clean/repair/change when needed

Well suited:

- Detecting PDs in metal-enclosed switchgear
- PD detection and evaluation in components, such as transformers or bushings where the PD is located close the component surface

Challenging applications:

- Detecting leakage of pressurized gases in HV equipment, for example bushings and switchgear. Acoustics cameras in general are not best suited for: GIS (gas insulated switchgear)
- Internal discharges deep inside components, such as transformers or bushings

ON-CAMERA ANALYTICS FOR PD



- Recognizes the sounds partial discharges emit and distinguishes them from other sounds, discarding all the non-relevant noise
- Reliably pinpoints partial discharges and shows their exact location clearly on the screen
- Automatically displays the PD pattern when a partial discharge is located
- Presents the sound pressure (dB) level that also indicates the strength and stage of the partial discharge

SI124-LD PLUS ACOUSTIC CAMERA FOR LEAK DETECTION

**COMPRESSED AIR COVERS 10%* OF ALL ENERGY CONSUMPTION
IN THE INDUSTRIAL SECTOR AND IS THE MOST EXPENSIVE UTILITY.**

**EASY AND RELIABLE GAS LEAKS DETECTION DRIVES
ORGANIZATIONS TO SAVE SIGNIFICANTLY THE COSTS AND
DECREASE THE RISK OF ACCIDENTS**

40–50% OF COMPRESSED AIR IS WASTED DUE TO AIR LEAKS.
IN LARGE FACTORIES, THIS EQUATES FINANCIAL LOSSES OF
SEVERAL €100,000.**

* <https://www.energy.gov/sites/prod/files/2014/05/f16/newmarket5.pdf>

**Dindorf, R: Estimating energy savings in compressed air systems

BENEFITS OF THE SI124-LD PLUS



AI-driven smart functionalities ensure a seamless user experience

- **AutoDistance:** automatically detects the distance between the leak and camera
- **AutoFilter:** automatically filters out disturbances in noisy, high decibel environments

Saves money and improves energy efficiency

- Shows the exact location of leaks and leak size and cost estimate: helps lower overall production costs
- Pinpoints leaks as small as **0.004 l/min**
- **Faster and more accurate** than other leak detectors and methods

Data for maintenance, repair plans, and ISO 50001 compatible reporting

- The included, machine learning-powered Si124 Cloud service offers advanced analytics and more in-depth reports on leaks

Speeds up audits & requires minimal training

- **Scans large areas quickly, combining both sonic and ultrasonic frequencies**
- The camera's intuitive user interface is easy to operate, can be introduced at any stage of your maintenance cycle

OPERATING THE SI124-LD PLUS

ON-CAMERA ANALYTICS FOR AIR LEAKS



- Recognizes the sound leaks emit and discards all the non-relevant sound
- **Reliably detects and pinpoints one or more leaks simultaneously and shows them clearly on the screen**
- AutoDistance feature automatically detects the distance between the leak and camera
- AutoFilter feature automatically filters out extraneous sound sources
- Automatically displays **leak size and cost estimate** in an understandable format
- Presents the sound level that also indicates a leak's size

SI124-LD PLUS BENCHMARK

- Best performing acoustic camera on the market as of 2023
- Very easy to use – minimal training required
- Lightweight, 1-handed operation
- Quantification of leak rates on camera and in software
- Web-based and offline software packages available for free
- FLIR Thermal Studio software suite compatible to maintain both thermography and acoustic analysis & reporting in the same package



ANALYTICS & SOFTWARE OPTIONS AIR LEAKS AND PARTIAL DISCHARGES


THERMAL STUDIO AND FLIR CLOUD ACOUSTIC SUPPORT

FEATURES SUPPORTED

- Full offline support (TS)
- **Partial Discharge Type Description** (Si124, Si124-PD)
 - Negative corona
 - Positive and negative corona
 - Floating discharge
 - Surface or internal discharge
- Automated severity assessment (Si124, Si124-PD)
 - **Severity assessment**
 - **Classification**
 - **Description**
 - **Recommended action**
- Graphs
 - Signal
 - FFT
 - Autocorrelation
 - Spectrogram (not implemented yet)
 - Cepstrum
- Templates
 - Partial Discharge (Si124, Si124-PD)
 - Leak Detection (Si124, Si124-LD, Si-124-LD Plus)
 - Combined Acoustic/ IR (possible to create in Standard and Pro versions)
- Leak analysis (Si124, Si124-LD, Si-124-LD Plus)
 - **Estimated leak size and annual cost**

SI124 CLOUD DEMO



- You can find the report generation tool in the Si124 Cloud: <https://si124viewer.flir.com/>
- For instructions in the system, press 
- You can try the tool with a **demo account**:
Username: flirdemo
Password: cyxgspphdatruvwx



The screenshot displays a thermal image of a power line tower. A heat signature is overlaid on the tower, showing a color gradient from blue (cooler) to red (hotter). Below the image is a volume control slider with a blue dot indicating the current level. The slider has labels for 39.6 dB, 44.6 Db, and 19.9 Db. To the right of the image is a sidebar with the following details:

Details	
Label:	AC100011_00034_180521_0901_0034
Serial:	ACTEST02
ID:	79
Creation date:	2018-05-21 09:02:13 GMT+0300
Synchronisation date:	2020-10-08 11:37:58 GMT+0300

Tags

Show only untagged

Filter by camera

6 cameras

BULK ACTIONS

Partial discharge type

Show only high and very high severities

Snapshot type

Label

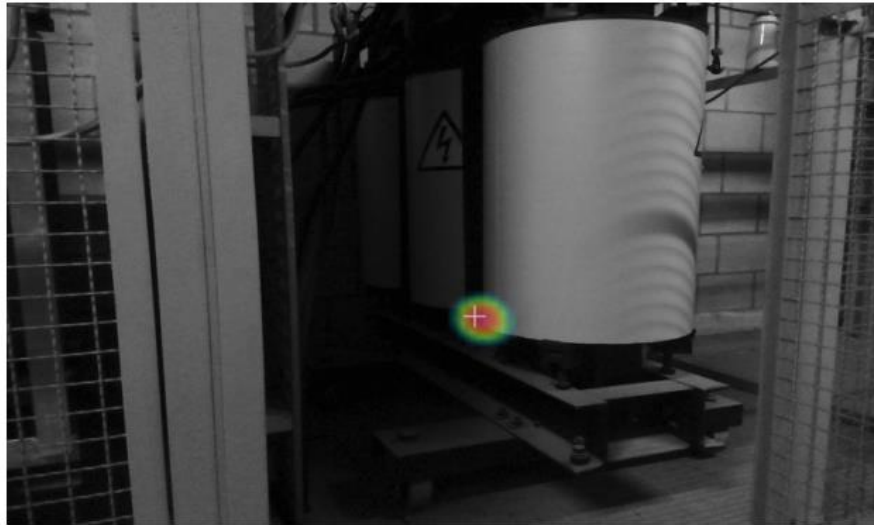
Sort by

Creation date, newest...

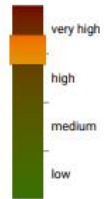
< 1 ... 5 6 7 8 9 >

2022-05-25

<p>DS SMITH PAPER ITALIA SRL <input type="checkbox"/></p>	<p>DS SMITH PAPER ITALIA SRL <input type="checkbox"/></p>	<p>DS SMITH PAPER ITALIA SRL <input type="checkbox"/></p>	<p>DS SMITH PAPER ITALIA SRL <input type="checkbox"/></p>
<p>DS SMITH Power electric SRL <input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p>Italy Terna <input type="checkbox"/></p>	<p><input type="checkbox"/></p>
<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p>DS SMITH Power electric SRL <input type="checkbox"/></p>
<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>



Severity



Description
This is classified as a surface or internal discharge. The discharge appears to be strong and might rapidly escalate to complete insulation breakdown.

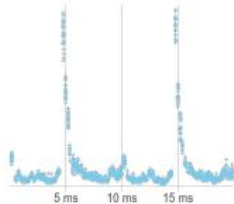
Recommendation
Immediate action. Visual inspection. Cleaning of polluted surfaces. Repair or replacement of the components.

Properties

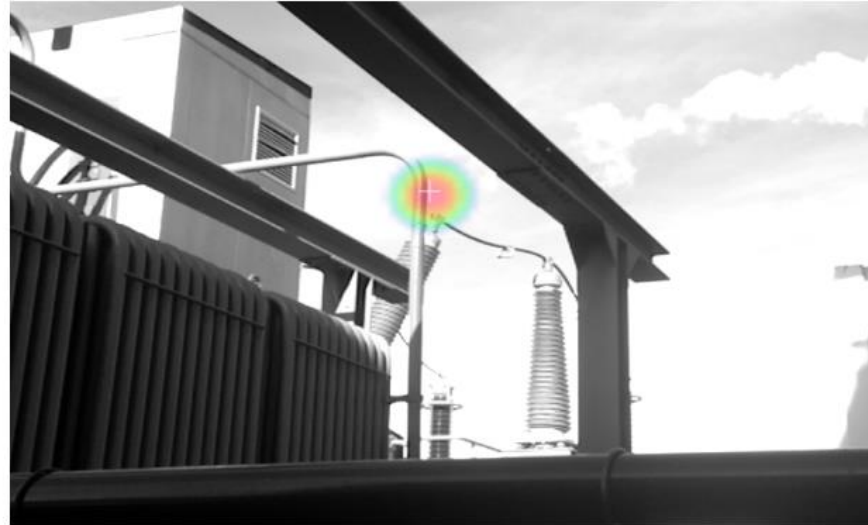
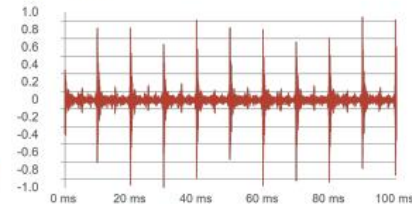
Level	25.9 dB
Date created	20.10.2022
Device	AC130093
Device Label	AC130093_00017_221020_1 231_0017
Distance	2 m
Voltage	10 kV
Location	transformer

Partial discharge type PRPD

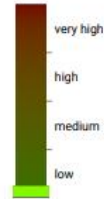
- negative corona
- positive and negative corona
- floating discharge
- surface or internal discharge



Waveform



Severity



Description
This is classified as corona, i.e., partial discharge into air. In most cases, corona is harmless.

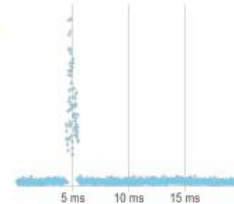
Recommendation
Typically no action required unless power loss, audible noise, electromagnetic interference, or deterioration of nearby polymer insulators is a problem.

Properties

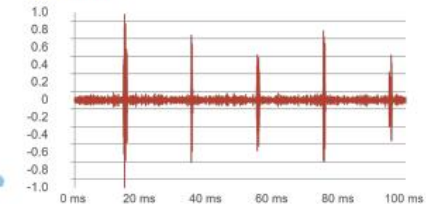
Level	4.3 dB
Date created	19.10.2022
Device	AC130093
Device Label	AC130093_00009_221019_1 301_0009
Distance	10 m
Voltage	150 kV
Location	bushing

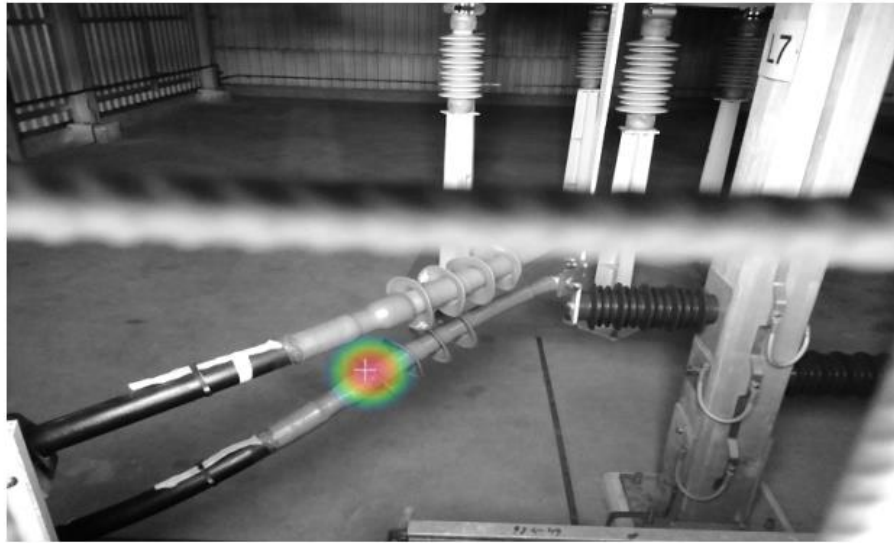
Partial discharge type PRPD

- negative corona
- positive and negative corona
- floating discharge
- surface or internal discharge

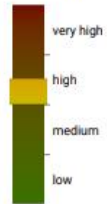


Waveform





Severity



Description
This is likely to be a strong surface or internal discharge. Surface or internal discharges on cables, terminations, and joints will progress over time and might rapidly escalate to insulation breakdown.

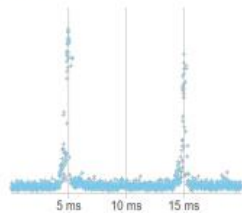
Recommendation
Visual inspection. Cleaning of polluted surfaces. Repair or replacement of damaged components.

Properties

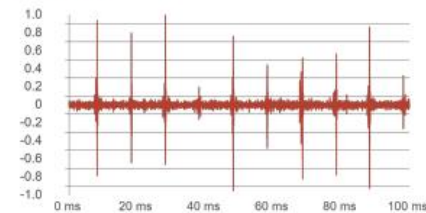
Level	7.6 dB
Date created	19.10.2022
Device	AC130093
Device Label	AC130093_00005_221019_1249_0005
Distance	2 m
Voltage	35 kV
Location	cable termination

Partial discharge type PRPD

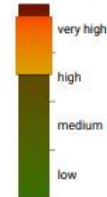
- negative corona
- positive and negative corona
- floating discharge
- surface or internal discharge



Waveform



Severity



Description
This is classified as a surface or internal discharge. The discharge appears to be strong and might rapidly escalate to complete insulation breakdown.

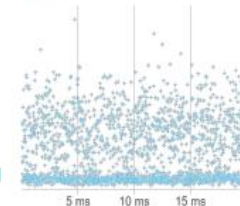
Recommendation
Immediate action. Visual inspection. Cleaning of polluted surfaces. Repair or replacement of the components.

Properties

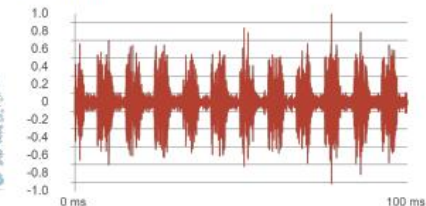
Level	10.4 dB
Date created	30.9.2022
Device	AC130092
Device Label	AC130092_00096_220930_1142_0096
Distance	15 m
Voltage	15 kV
Location	polymer suspension insulator

Partial discharge type PRPD

- negative corona
- positive and negative corona
- floating discharge
- surface or internal discharge



Waveform



[Home](#)[PREVIOUS](#) [NEXT](#)

DELETE

?



Details

Label:

ICT S.p.A

Serial:

AC130020

ID:

112257

Level:

65.3 dB

Creation date:

2022-05-25 11:12:01 GMT+0300

Synchronization date:

2022-06-03 10:26:49 GMT+0300

63 dB



-24.9 dB

65.3 dB

Leak analysis

Distance

4

m away

Utilization hours

24

Utilization days

7

Utilization weeks

52

Advanced

Temperature (environment)

20

°C

Humidity (environment)

50

%

Specific power

11.7

 $\frac{\text{kW}}{(\text{m}^3/\text{min})}$

Energy cost

0.14

€ / kWh

Estimated leak size: 58 l/min

Estimated annual cost: 828 € / year

Compressed air



STAND A07 - MINERVA