

Diagnostic for high-speed train electrical subsystems



Take advantage of Techimp GLOBAL Monitoring System “diagnostics all in one”



Introduction

High-speed train network projects and installations are growing rapidly in most world countries, becoming an increasingly attractive alternative to flying.

Pulse Width Modulated (PWM) adjustable speed devices are already widely employed in high-speed locomotives for their significant advantages of control and efficiency. Inverter-fed motors, transformers, braking rheostat and in general power electronics, are critical components for the reliability of the train.

Indeed, large overvoltages together with short rising time and high repetition rate, caused by the supply waveform can lead to **premature failure of insulations of electrical components**, causing train stop.

The strategic importance of these assets, together with the technological and economical challenges brought about by the development of high-speed passenger transport railways, have emphasized the issue of **reliability of trainsets drive systems**.

Most insulation failure modes lead, sooner or later, to the inception of partial discharges (PD). As a consequence, early detection of PD events can help preventing trainset failures .

Introduction

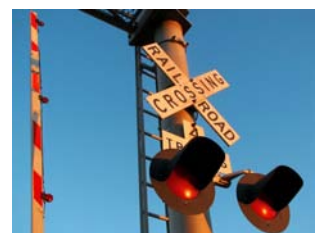
PD measurements can be carried out both on-line with the equipment under test supplied by the electric network on board and off-line, with the electrical system supplied by an external voltage source. However, off-line tests can be carried out only periodically, when the power car is under maintenance. Moreover, stress profiles in offline tests may be noticeably different from those experienced in service

Therefore, **the ideal solution for the prevention of electrical failures is the permanent on-line partial discharge monitoring of the electrical assets on board.**

Techimp Systems has devised a dedicated solution in order to keep the insulation of the electrical equipment on board always under control.

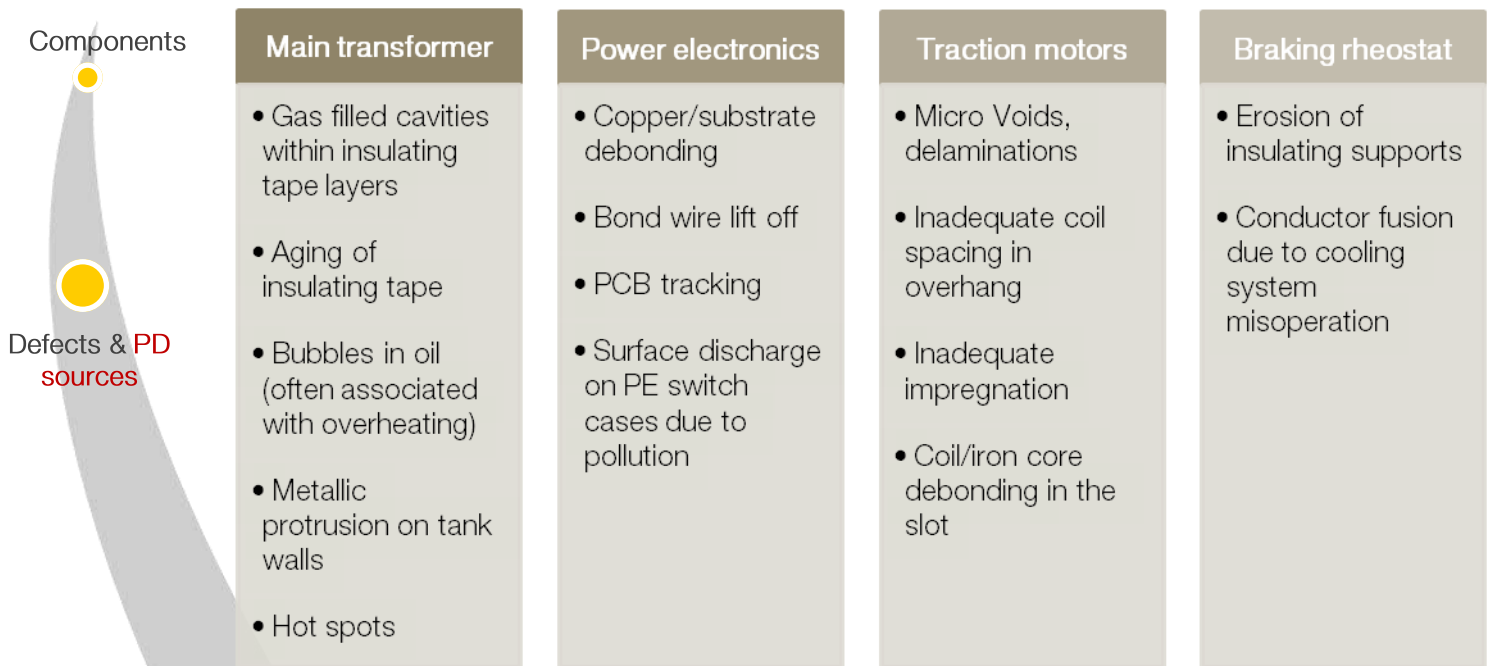
One of the critical issues for the measurement and diagnosis of traction motors and power car components may be represented by the repetitive impulsive waveforms generated by the frequency drives.

Techimp in the last years has addressed also this issue and has developed an ultimate technology suitable also for converter fed motors and, in general, Adjustable Speed Drive (ASD) applications.



As a matter of fact, Techimp monitoring systems represent the ideal and ultimate solution for the CBM of electrical apparatus, in particular those for drive systems of trainsets.

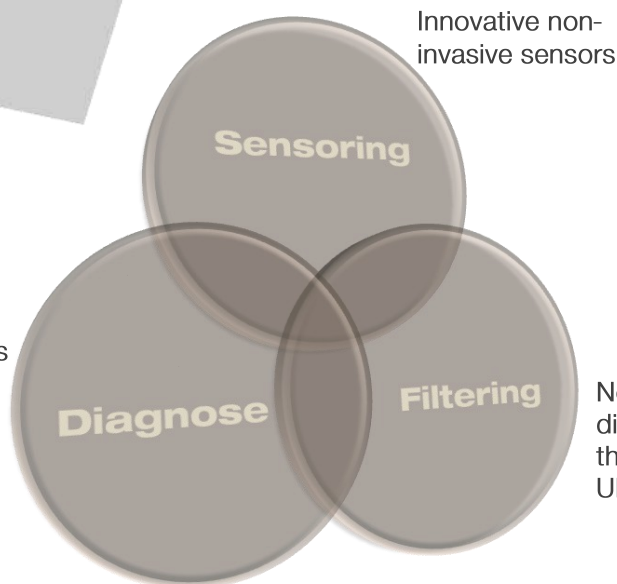
Diagnostic for power car electrical subsystems: Components, Defects and Tasks



Most of the above defects or design deficiencies cause Partial Discharge (PD)

Diagnostic of power train electrical components through PD detection and analysis

Evaluate PD Source (Identification) nature and fault severity assessment through statistical analysis of PD data (Magnitude, repetition rate,....)



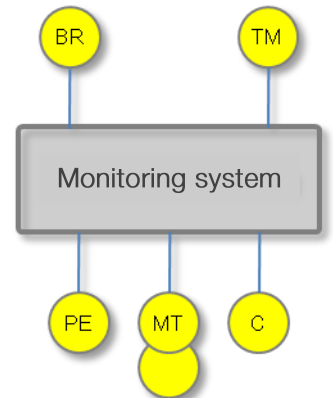
Noise and power electronics disturbance removed through combined use of UHF sensors and filters

Partial Discharge monitoring system

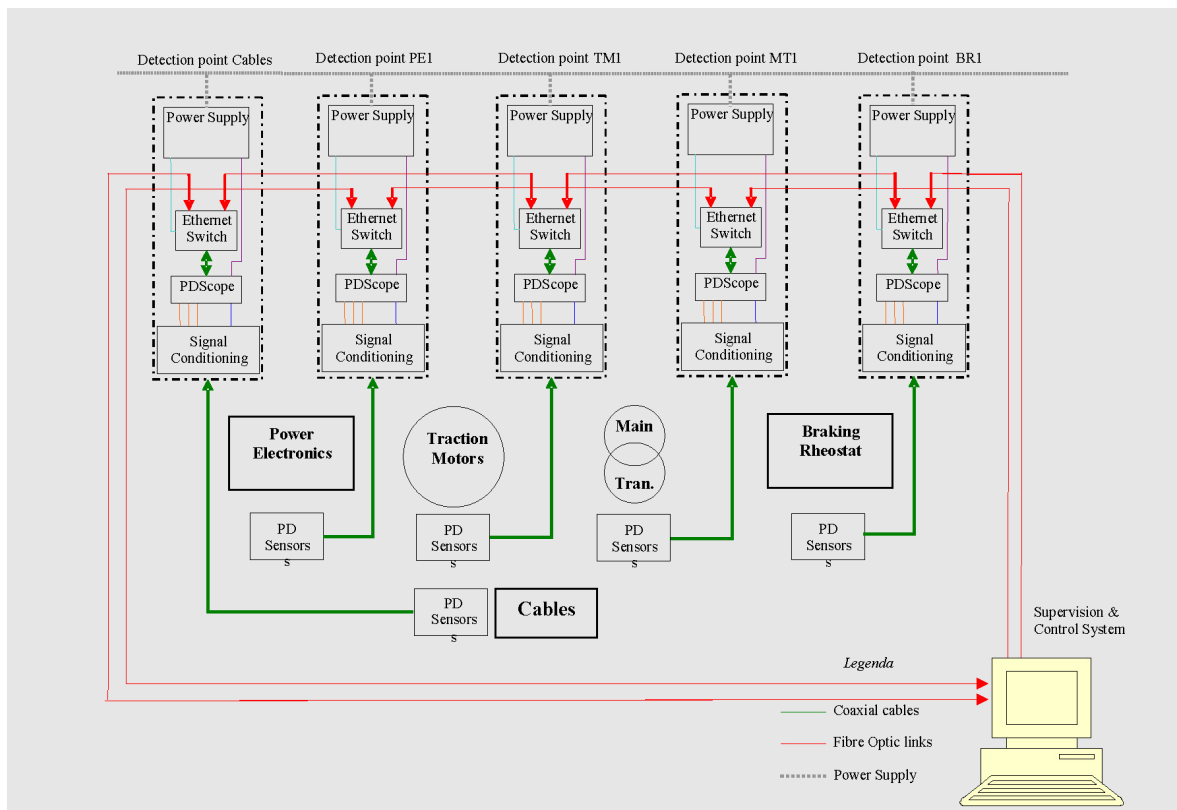
The system is aimed at acquiring, processing and analysing partial discharge pulses originated in the MV electrical equipment installed on board, i.e.:

- Main Transformer (MT);
- Power Electronics (PE);
- Traction Motors (TM);
- Braking Rheostat (BR);
- Cable links (C).

Since Partial Discharges are symptoms of degradation of the insulation, the system hereby described is able to keep the insulation of the electrical systems permanently under control and provide alarms in case PD phenomena become potentially dangerous for the equipment.



System Architecture



Example of system architecture

Partial Discharge monitoring system

The PD Monitoring system consists of:

Sensors & Couplers as PD sensors (e.g. capacitive coupler for motors and generators)

Partial Discharge Detection Points, equipped with a “PDscope”, an Ethernet Switch and a power supply and signal conditioning device;



PDscope

Fibre optic Communication Network for the signal transmission, to link the detection points and the central control system. The communication network is based on the *Link Loss Learn* technology which, in case of failure in one point of the network, allows restoring the connection on an alternative data route, thus improving the system reliability;

Central Control System. It includes one Server with software to manage the whole system and a database for PD data.

Main system features:

Digitizer. Each acquisition point is provided with a peak detector system for a fast pattern detection, as well as with a 100MS/s digitizer, so that it is possible to acquire the complete waveform of each PD signal in order to separate and identify efficiently different PD activities (bandwidth from 10KHz to 40 MHz).

Separation and Noise rejection. Thanks to the Techimp innovative technology based on pulse analysis (TF map[®]), the system is ideal for “on-line” application, since its unique features allow an excellent noise and disturbance rejection, as well as separation of different PD phenomena.

System modularity and possibility of further expansions. The system can be easily expanded. There is no theoretical limit of the acquisition units which may be connected to the same control system: PD sensors and acquisition units can be installed on any electrical assets of the electrical system, such as generators, motors, main switchboard, distribution transformers, measurement transformer and cable links.

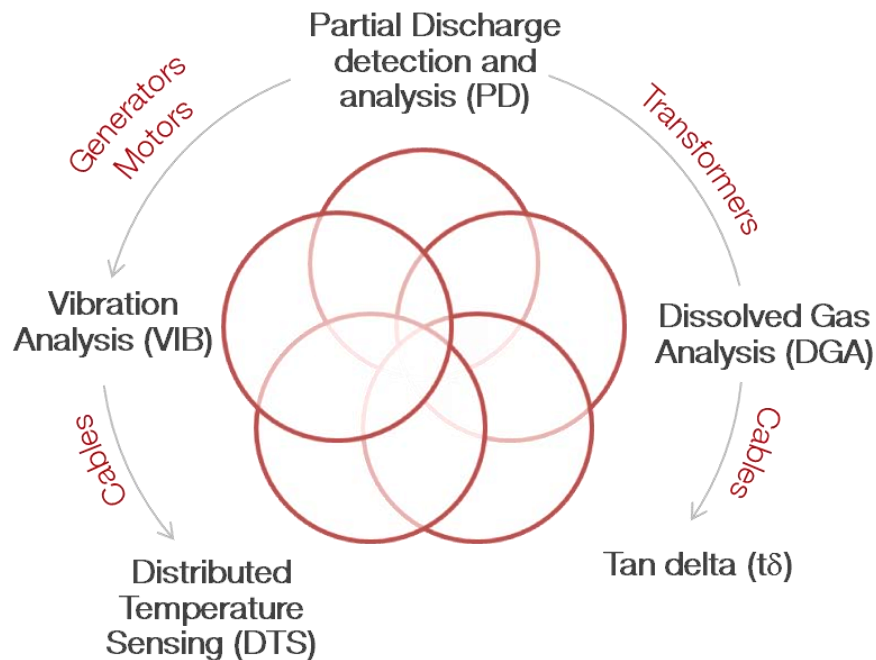
PD activity at a glance. The supervision & control system allows the operator to check the situation and the PD activity of all the electrical apparatus in the electrical system.

Alarms. General alert and smart alerts based on identified insulation defects.

Diagnostic data-base. Possible cross correlations among the stored data, to be customized on the basis of customer requirements or according to peculiar findings.

Take advantage of Techimp GLOBAL Monitoring Systems on line diagnostics all in one

Based on multiple on-line diagnostic advanced techniques



1 detector
many
sensor types

On line diagnosis of ALL electrical apparatus

Our Vision:

Apparatus

- ✓ Multiple subsystems
- ✓ Multiple failure modes

Approach

- ✓ One apparatus where multiple sensors provide complementary information
- ✓ Shrink monitoring costs
- ✓ Exploit synergies between information provided by different diagnostic techniques
- ✓ Enhance diagnostic capability and apparatus reliability
- ✓ Reduce overall maintenance costs

For news and further information please visit us at www.techimp.com

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