

# Diagnostics and Condition Monitoring of High Voltage Switchgear

Bologna (Italy), July 8-9 2015



## Scope

The course is aimed at providing the fundamental concepts of diagnostics and condition monitoring of high voltage switchgear. The failure modes of switchgear components will be dealt with, highlighting their symptoms, likelihood and consequences. For each failure mode, the possible diagnostic tools will be reviewed. This will enable the participant to choose in an informed way between alternative diagnostic techniques. At the end of the course, the participant will be able to:

- Select diagnostic tools.
- Allocate capital expenditures for diagnostics.
- Understand the information brought about by the different diagnostic tools.

Potential attendees are operators and maintenance engineers, supervisors and technicians from both industry and utility. The approach will be informal, with theoretical issues treated in the simplest way possible. Questions will be encouraged.

## Program

### Part 1: Stresses Acting on High Voltage switchgear

- 1.1 Principles of current interruption
- 1.2 Thermal and mechanical stresses
- 1.3 Interrupter technology: SF6 and Vacuum
- 1.4 Switching and interruption duties: terminal faults, Short line faults, Reactive switching
- 1.5 Switching transients and mitigation methods
- 1.6 Electrical Insulation of High Voltage Equipment

### Part 2: HV Testing and Partial Discharge Diagnostics

- 2.1 Voltage Stresses.
- 2.2 Testing voltages.
- 2.3 Partial Discharge
- 2.4 Onsite Partial discharge detection methods.
- 2.5 PD diagnostics in High Voltage Switchgear

### Part 3: Needs for Condition Monitoring.

- 3.1 Maintenance paradigms
- 3.2 Purposes of monitoring.

### Part 4: Switchgear Condition Monitoring

- 4.1 Switchgear failures.
- 4.2 Switchgear Insulation: gas monitoring
- 4.3 Current Carrying.
- 4.4 Switching.
- 4.5 Mechanical operation.
- 4.6 Control and auxiliary functions.

### Part 5: Tools for partial discharge detection in switchgears

Tools for PD detection and analysis will be presented by experts of the company Techimp HQ Spa, a renowned PD detector manufacturer.

## Course Leaders

[Prof. Andrea Cavallini](#) is associate professor at the University of Bologna. He has an extensive research experience in the field of partial discharge diagnostics. He is active in the IEEE and in CIGRE WGs. He coauthored more than 230 papers

[Dr. Jose Lopez-Roldan](#) has been working in development, design, testing and condition monitoring of HV switchgear for research centers, manufacturers and utilities around the world such as EDF and Schneider Electric in France, Ontario-Hydro in Canada, Reyrolle Switchgear (now Siemens) in UK, Pauwels in Belgium. He is currently principal engineer at Powerlink in Australia. He is member of several CIGRE WGs in condition monitoring of HV switchgear.

## Practical information

### Venue

Dept. of Electrical, Electronic and Info. Engr.  
Viale del Risorgimento 2, Bologna, Italy

### Registration fees

The registration fee is:  
800 € (+22% VAT) **before** June 6 2015  
990 € (+22% VAT) **after** June 6 2015  
Payment will be through wire transfer.

### Registration and information

e-mail: [andrea.cavallini@unibo.it](mailto:andrea.cavallini@unibo.it)

### Minimum/maximum number of participants

The course will be held for a number of participants not lower than 10. The maximum number of participants is 20.

**The final decision about holding the course will be given to potential attendees on 8/6/2015**

### Travel information

Bologna is located in the north of Italy, at about 80 km and 150 km from Florence and Venice, respectively. The city is easily accessible through its international airport (Bologna Marconi, BLQ) or by train.

## Important dates

**June 6 2015** early bird registration expires.  
**June 8 2015** final decision about holding the course is communicated. Payments starts.  
**July 8-9 2015** course dates.



DIPARTIMENTO DI INGEGNERIA  
DELL'ENERGIA ELETTRICA E  
DELL'INFORMAZIONE "GUGLIELMO  
MARCONI"