



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

*Agenda is subject to change.*

### **LEGEND**

- TP:** TRANSFORMER PROFESSIONAL PROGRAM (M-TH)  
**TP -A:** TRANSFORMER PROFESSIONAL PROGRAM - ADVANCED TRAINING (M-TH)  
**TM:** TRANSFORMER MAINTENANCE PROGRAM (W, TH, F)  
**DP:** TRANSFORMER DIFFERENTIAL PROTECTION PROGRAM (M-TH)  
**LS:** LABORATORY SEMINAR (F)

**Note:** There is no need to pre-register for particular sessions. Simply choose the session that's right for you.

## **Sunday, February 19, 2017**

**12:00 PM – 6:00 PM**

*Registration & Information Desk Open*

**12:00 PM – 6:00 PM**

*Registration & Information Desk Open*



### **2:30 PM – 6:00 PM Optional Tours: GE Transformer Remanufacturing Service Center Tour**

GE's Los Angeles Service Center features in-shop service for transformer, motor, mechanical, steam turbine, and generator repairs. GE has the largest network of transformer repair facilities in North America. Each facility has capabilities to remanufacture and test transformers to any standard. Facilities can handle all sizes and all manufacturers up to 500KV and 500MVA. In addition GE can remanufacture all types of transformers of both core and shell type manufacture including power, mobile, furnace, regulators, dry, rectifiers, reactors, network, rail undercar and phase shifters.

**Note:** This pre-seminar tour has limited capacity and is open on a first-come, first-serve basis. Confirmation of tour participation is subject to GE approval and will be provided in advance of the seminar.



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

### Monday, February 20, 2017

7:00 AM – 6:00 PM

*Registration & Information Desk Open*

7:00 AM – 8:00 AM

*Attendee Breakfast*

#### TP &

**DP** 8:00 AM – 8:15 AM

**Welcome & Introduction**

Bryan Sayler, President

**Doble Engineering Company**

*Bryan Sayler brings 28 years of experience developing and implementing highly engineered test solutions for wireless, EMC and microwave applications in the electronics, automotive and aerospace industries. Prior to joining Doble, Mr. Sayler was Sr. Vice President Solutions Development at ETS-Lindgren where he led global project management, hardware, software and strategic solutions development through active participation in global standards bodies including IEEE, CTIA, 3GPP and the WiFi Alliance.*

#### TP &

**DP** 8:15 AM – 8:45 AM

**Opening Keynote**

Paul Grigaux, Vice President, Transmission, Substation and Operation

**Southern California Edison**

#### TP &

**DP** 8:45 AM – 9:15 AM

**Primer on Large Power Transformers**

Jeff Short, Manager, Client Service Engineering

**Doble Engineering Company**

As we move forward into the 21st Century, the use of electricity by mankind has evolved into a necessary staple of everyday life. But it wasn't always this way. The advent of power transformers in today's world is a function of necessity, a product of ingenuity, and a marvel of technology. Power transformers are the key element in the present system of electrical power distribution, and this system could not function without transformers. Let's take a look at why and how they were developed.

9:15 AM – 9:30 AM

*Break*

#### TP &

**DP** 9:30 AM – 10:30 AM

**Transformer Specification & Vendor Prequalification**

Bill Griesacker, Principal Engineer



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

### Doble Engineering Company

An effective procurement system utilizes the preapproval process to identify suitable power transformer vendors and a design review to establish an agreed upon design and procurement process. This preapproval approval process should include factory qualification audits which are essential to confirm a manufacturer's ability to meet a purchaser's requirements and expectations. The design review is performed to establish an agreed upon design and to facilitate the procurement process. That the supplier is capable of meeting the purchaser's procurement specifications is confirmed during this process and the procurement process is expedited by bringing the purchaser and supplier together on the technical details of the purchased transformer.

**Bill Griesacker** is a member of Doble Engineering Company as a transformer engineer working on projects that include factory inspections, condition assessment, design reviews, failure analysis and general consulting. He previously worked for Pennsylvania Transformer Technology Inc., where he held various positions including Engineering Manager. His work included high voltage insulation design, transient voltage modeling of power transformer windings and various LTC and DETC switch development projects. Prior to this, he was employed by the Westinghouse Electric Company, working on synchronous generator projects as a member of the Generator Engineering Department. Mr. Griesacker started his career with Cooper Power Systems in large power transformers and later worked in the Kyle Switchgear, Vacuum Interrupter Department. He has earned a MS in electric power engineering from the Rensselaer Polytechnic Institute and a BS in electrical engineering from Gannon University. Mr. Griesacker is an active member of the IEEE, PES Transformers Committee where he holds positions in several working groups and subcommittees.

## TP &

**DP 10:30 – 12:00 PM**

### Transformer Design & Manufacturing

Dharam Vir, Vice President of Engineering

Troy Kabrich, Vice President & General Manager – Services Division

**SPX Transformer Solutions, Inc.**

Transformers are tailor made products. The design process begins with understanding customer requirements. Using optimization programs a quote design is provided with the lowest total owning cost meeting customer requirements. During final design detailed dielectric, short circuit and thermal calculations are performed to ensure the transformer meets performance and customer requirements. The mechanical design of the tank, stiffeners, lifting and clamping structures enables the unit to withstand vacuum, pressure, short-circuit, seismic and shipping conditions. Design verification is done by performing routine and type tests on the unit.

**Dharam Vir** joined SPX Waukesha in 2004 with over 25 years of service to the transformer industry in EHV design, testing, production and plant operations. Prior to his current position, he held the positions of Engineering Manager for the Waukesha plant and director of our EHV program, leading the team responsible for the Waukesha facility expansion. Mr. Vir is an active member of the IEEE Transformers Committee and holds a



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

*BSEE from University of Delhi India, a MS in Electrical Engineering from NIT Bhopal India and an MBA in Finance and Marketing from Bhopal University India.*

**Troy Kabrich** is currently the Vice President & General Manager for the Goldsboro, NC Manufacturing Plant and the Service and Components Division of SPX Transformer Solutions, Inc. During his twenty-five years of industry experience, Mr. Kabrich has held positions as a Plant Manager, Director of Field Services, Repair Operations Manager, Field Service Engineer, and Sales Engineer. He has published articles for T&D World and Utility Automation and Engineering magazines, was author of Installation and Maintenance Chapter of Third Revision of the Electric Power Transformer Engineering Handbook, and is a frequent contributor to industry training programs. Troy has a Bachelor of Science degree in electrical engineering from Rose-Hulman Institute of Technology.

**12:00 PM – 1:00 PM**

**Lunch**

**TP &**

**DP 1:00 PM – 1:45 PM**

**Global Transformer Market Sourcing Considerations**

Patricia Hoffman, Assistant Secretary Office of Electricity Delivery and Energy Reliability

**Department of Energy**

**TP &**

**DP 1:45 PM – 3:30 PM**

**Understanding Factory Testing Data**

Mark Lachman, Director of Diagnostic Analyses

**Doble Engineering Company**

Kirk Robbins, Senior Staff Engineer

**Exelon Nuclear**

This presentation briefly describes significance of various electrical production tests with bulk of material arranged around a typical test plan covering all final factory tests as per IEEE C57.12.00-2010 and C57.12.90-2015. For each test, there will be an in-depth discussion of each measurement, physics behind the measurement, setup and test methodology and acceptance criteria.

**Mark F. Lachman, Ph.D., P.E.,** has been with the power industry for over 30 years. In 2005, he joined Delta Star in San Carlos, CA, where, as Test Manager, he was responsible for the test department operation. In 2011, he returned to Doble Engineering Company as Director of Diagnostic Analyses.

**3:30 PM – 3:45 PM**

**Break**





# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

### TP &

**DP** 3:45 PM – 4:30 PM

#### Shell-Form Design & Construction

Dom Corsi, Senior Transformer Consulting Engineer

**Doble Engineering Company**

Although transformers are typically referred to according to their role in a power system, they are also classified according to their construction: core-form or shell-form. This webinar will cover history and development of shell-form transformer designs in N. America and comparison of typical shell-form and core-form design features & construction, maintenance and diagnostic testing, and replacement consideration. Shell-form technology was developed by Westinghouse Electric Corporation and was licensed to a number of transformer manufacturers world-wide. The core-form technology was favored by General Electric. Traditionally shell-form transformers were commonly found in applications above 100 MVA and 230 kV such as generator step-up transformer, transmission autotransformer, shunt reactor, mobile substation and arc furnace transformer applications.

*Dom Corsi has 27 years of experience in the manufacturing and electrical design of large power transformers. This experience includes both core and shell form designs. Mr. Corsi joined Doble in 2004 as a Transformer Consulting Engineer for Doble Global Power Services. In the last 12 years, he has concentrated on electrical power apparatus testing, condition assessment, and forensics. Additionally he has designed transformers up to 400 kV and 570 MVA and reviewed or supervised transformer designs to 525 kV and 1100 MVA. His main interests are in the fields of power transformer design, and power transformer applications. A frequent presenter, Dom Corsi trains participants on many transformer related topics including Transformer Repair, Remanufacturing and Replacement, Transformer Design Review, Transformer Factory Inspections.*

### TP &

**DP** 4:30 PM – 5:15 PM

#### Insulating Materials Basics

Lars Schmidt, Technology Lead Center Manager – Insulation

**ABB Inc.**

This session offers an overview of power transformer insulation with a focus on cellulose based insulation materials. Both raw materials and the conversion of cellulose to transformer board will be discussed including environmental considerations. The main function of cellulose insulation in a power transformer will be covered and the electrical, mechanical, and aging properties of pressboard, pressboard laminate and laminated wood will be discussed.

**Lars E. Schmidt** is the Product Line Technology Manager for Transformer Insulation at ABB and located in Bad Honnef, Germany. He is responsible for the development of new insulation materials and manufacturing processes since 2011. ABB produces transformer insulation in different factories including Sweden, India, and Germany. Lars joined ABB Corporate Research in 2006 and worked in the field of polymer based medium and



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

high voltage insulation. He has a background in Material's Science and holds a PhD from the Swiss Federal Institute of Technology, Lausanne.

### TP &

**DP** 5:15 PM – 5:45 PM

**Ask the Experts Panel**

5:45 PM – 6:45 PM

*Doble Product Display & Reception*

7:00 PM – 10:30 PM

*Welcome & Networking Event at Pacific City*

*All are welcome to attend the welcome event at nearby Pacific City. Sponsored by SPX Transformer Solutions, Inc. and GE this event includes great local food and drink and conversation with colleagues in a relaxed and casual atmosphere.*



## Tuesday, February 21, 2017

7:00 AM – 6:00 PM

*Registration & Information Desk Open*

7:00 AM – 8:00 AM

*Attendee Breakfast*

**TP** 8:00 AM - 8:45 AM

**Autotransformers**

Henk Fonk, Senior Electrical Design Engineer

**SMIT Transformers**

Auto-transformers have several advantages over 2-winding transformers with the same output power, such as lower weight, lower losses and hence lower costs. Auto-transformers call for several unique design considerations which require special attention and careful study. These considerations will be addressed during this presentation.



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

**Henk Fonk** joined SMIT as test engineer in the High Voltage Test Lab in 1991. After 3 years he moved to the test department for small power transformers. In 1998 he joined the design department as an electrical design engineer for small power transformers. In this position, he has designed transformers up to 20 MVA with a maximum voltage of 36 kV. In 2000 he moved to the large power transformers and started a part time study Electrical Engineering at the University of Applied Science in Arnhem. In 2005 he finalized this study with a graduation project at TenneT on the subject “Modelling inrush behaviour of the Phase-shifter in Meeden”. Mr. Fonk has been involved in the design of large power transformers and special applications like phase shifters and converter transformers for the past decade. Since 2008 he has been a member of CIGRE NSC D1 and the Dutch representative for CIGRE SC A2 since 2014.

### TP-A 8:00 AM – 8:45 AM

#### Arc Furnace Transformer & Rectifier Transformers

Renato Gamba, Sales & Development Solutions Engineer

Luca Cremaschini, Export Sales Manager

Tamini Trasformatori S.r.l.

The Arc Furnace Transformer is the key equipment in a steel plant and all possible efforts have to be made in order to avoid its outages. An optimized and dedicated design and construction process, a customized set of external protections for preventing overvoltage and, a regular and scheduled maintenance and diagnosis program are the keys for achieving a reliable and durable product. This session will discuss all these aspects, pointing out the tougher challenges that the furnace transformer has to face during its life and strategies and solutions adopted in order to make the transformer ready for its task.

**Renato Gamba** is Technical Solutions Developer and Export Sales Engineer at Tamini Trasformatori in Milano, Italy. An Italian native, Mr. Gamba has been with Tamini since 2006 and has held positions of Electrical Design Engineer and Service and Customer Assistance Manager. Mr. Gamba holds a Master of Science degree in Electrical Engineering and graduated from the Politecnico di Milano with distinction.

**Luca Cremaschini** is Export Sales Manager at Tamini Trasformatori and from 2016 is supporting the US local branch Tamini Transformer USA. An Italian native, Mr. Cremaschini has been with TES Transformer Electro Service, now merged with Tamini, from 2015. Mr. Cremaschini holds Master of Art degree in Political Science from the “Università di Bologna” and a Bachelor Degree in Economics from the “Università degli Studi di Brescia”.

### DP 8:00 AM – 10:15 AM

#### Introduction to Transformer Differential Protection

Ed Khan, Director of Protection Training

Doble Engineering Company

**Ed Khan** has been with Doble for more than 6 years working in various capacities including product manager for protection tested related instruments. Prior to Doble, Mr. Khan has worked for GE, ABB, SEL, KEMA and others in



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

*various capacities. He has over 30 years of experience in system studies, protection applications, relay design, power plant design, teaching and product management. He has a thorough knowledge about product development, protection, harmonic analysis, harmonic filter design, stability studies, Real Time Digital Simulations, generator protection and more. He has presented courses on behalf of Doble globally and has been an invited speaker for utilities and industrial customers in Southeast Asia, Middle East, Mexico, India and China. He is a member of CIGRE working group B56.5 focusing on the optimization of protection and controls.*

**TP 8:45 AM – 9:30 AM**

### **Mobile Transformers & Substations**

Marion Jaroszewski, Senior Consultant  
**Delta Star, Inc.**

Steve Larson, Manager, Substation Construction and Maintenance  
**Snohomish Public Utility District**

Types and applications of mobile substations are presented. A mobile versus power transformer is discussed with emphasis on the temperature ratings and associated with it hybrid insulation system, short circuit and dielectric strength, oil preservation and cooling system design. The mobile transformer and substation testing is discussed. The essentials of specifications and trailer components are also addressed.

***Marion Jaroszewski's** expertise is in design of transportable (mobile and portable) high temperature transformers and substations as well as core type power, generator step up, auxiliary and grounding transformers, autotransformers and voltage regulators. Mr. Jaroszewski graduated from Technical University of Lodz, Poland with EE degree in 1973. His master thesis was Methods of Calculation of Optimal Dimensions of Active Parts of Power Transformers. He began his professional career with Transformer Manufacturer ELTA in Lodz, Poland. He moved to the United States in 1981 where he worked as a Transformer Engineer for Alamo Transformers in Houston. In 1985 was hired as a Design Engineer by H.K. Porter in Belmont, California and two years later was promoted to Senior Design Engineer position. In 1988, two H. K. Porter transformer plants in Belmont, CA and in Lynchburg, VA were bought by employees and became again Delta Star, Inc. In 1995, Marion was promoted to Manager of Engineering position. He was promoted to Corporate Technical Officer in 2004. The same year he was promoted to San Carlos Operations Manager and to Vice President of the company in 2005. Marion retired at the end of 2009 and currently works part time as a consultant and technical advisor for Delta Star, Inc. He is Life Member of IEEE and active participant in Transformer Committee working groups.*

***Steve Larson** is Manager of Substation Construction and Maintenance at Snohomish County Public Utility District. He has a Master's degree in Electrical Engineering from University of Colorado and is a licensed Professional Engineer in Washington state. Steve is a Senior Member of IEEE, former Doble Circuit Breakers committee chairman, and is currently the Vice-Chairman of the Doble Advisory committee.*

**TP-A 8:45 AM – 9:30 AM**

### **HVDC**

Waldemar Ziomek, Senior Global Expert – Power Transformers  
**PTI Manitoba Inc.**





# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

The electric power systems – generation, transmission and distribution - are generally employing AC-based technology. However, in many situations using transmission with HVDC is beneficial for economical or technical reasons. The HVDC converter transformers used in such system are subjected to specific operational conditions resulting from presence of DC potentials and flow of DC currents. The presentation will discuss benefits of HVDC transmission and its history, HVDC schemes, transformer design, dielectric requirements (for AC, DC, and polarity reversal stresses), issues associated with current harmonics, DC current excitation and related losses. HVDC transformer manufacturing and processing requirements will be also discussed. Finally, some typical problems and test failures will be presented.

***Dr. Waldemar Ziomek** works as a senior expert - power transformers and high voltage insulation, for PTI Manitoba Inc, Canadian manufacturer of power transformers. In 2013-2015 he worked for CG Power Systems, an international T&D equipment company, as a global senior expert. Till 2013 he was employed by CG Power Systems Canada Inc (formerly Pauwels Canada Inc) as Manager of Engineering. He started with Pauwels in 1997 as an electrical designer, then in 1999 as an electrical engineering manager, and since 2003 as manager of engineering. Since 2001 he is also an adjunct professor at The University of Manitoba.*

**TP 9:30 AM – 10:15 AM**

### **Generator Step-Up Transformer Overview**

Jeffrey C. Wright, P.E., Senior Electrical Engineer – Power Transformer Division  
**Mitsubishi Electric Power Products Inc.**

Generator Step-up Transformers (GSU's) are a specific application that can present unique challenges to both the user and the manufacturer. The purpose of this presentation is to demonstrate how the unique parameters of this application can impact the design and construction of the transformer.

***Jeffrey Wright** has worked as a design engineer and consultant on Shell-form and Core-form Power Transformers for 40 years. Since 2014 Mr. Wright has been with Mitsubishi Electric Power Products, Inc. (MEPPI) in Memphis, TN. Previous engagements have included transformer design and consulting positions at McGraw-Edison, Cooper Power Systems, ABB, Weidmann-ACTI, Allegheny Power (First Energy), and Pennsylvania Transformer Technology, Inc. Mr. Wright is a graduate of Carnegie-Mellon University and is a registered Professional Engineer in Pennsylvania. Mr. Wright is a member of the IEEE Standards Association and Transformers Committee.*

**TP-A 9:30 AM – 10:15 AM**

### **Dry Type Transformers**

Kevin Eaton, Business Development Leader  
**ABB Inc.**

In this age of deregulation, the need for operating cost reductions and the scarcity of capital for new equipment; users are looking for ways to better use existing equipment and new purchases. Overloading of transformers or how to more effectively use transformers is a general topic of discussion. Exceeding the rating of a transformer in previous years was normally due to an emergency situation. However, in today's environment, overloading of



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

transformers is becoming a part of the planning process. The purpose of this presentation is to discuss some of the issues surrounding this topic. This presentation will cover both liquid and dry type transformer insulation system ratings and the typical uses and applications for each type of transformers utilized.

**10:15 AM – 10:30 AM**

**Break**

**TP 10:30 AM – 12:00 PM**

**Transformer Bushing Fundamentals**

David Geibel, Technical Director

**ABB Inc.**

This session will address the fundamental theory, design, and application of fine graded condenser bushings. This discussion will include advantages and limitations of legacy OIP bushings and state-of-the-art oil-less, non-ceramic "dry" bushings.

*David Geibel started out at General Electric Co. in Pittsfield MA over four decades ago and became a transformer components engineer. GE sold him to Westinghouse and Westinghouse sold him to ABB. Mr. Geibel has been the Engineering Manager for the ABB Alamo transformer components plant for about the past decade and have recently transitioned over to Technical Director. He graduated Magna Cum Laude from the University of Pittsburgh with a BSEE and holds several transformer components patents.*

**TP-A 10:30 AM – 12:00 PM** **Geomagnetic Induced Current (GIC) Disturbance Mitigation: NERC TPL-007-1 Compliance**

**Part 1: Exelon Geomagnetic Disturbance Assessment Strategy**

Sami Debass, Senior Staff Engineer

**Exelon Nuclear**

**Part 2: GIC Thermal Impact Assessment Requirements**

Dom Corsi, Senior Transformer Consulting Engineer

**Doble Engineering Company**

The NERC standard TPL-007-1 Compliance presentation will cover geomagnetic disturbance (GMD) risk mitigation on large power transformers. The standard requires that generation and transmission asset owners must conduct a thermal impact assessment is required for all applicable high-side, wye grounded >200kV transformers to ensure they can withstand thermal transient effects associated with benchmark GMD event. IEEE C57.163-2015 guide was developed to provide a background that can help evaluate the effect of GIC on a power transformer design and its GIC capability. This presentation will cover the transformer design information inputs required to perform the thermal impact assessment and the challenges associated with older transformers where design documentation may not be available.



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

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**DP 10:30 AM – 12:00 PM**

**Differential Protection Application and Testing Procedures: : ABB RET670**

Mike Kockott

ABB

**12:00 PM – 1:00 PM**

**Lunch & Heavy Equipment Demonstrations**

ABB, Delta Star, GE and Siemens heavy equipment will be on display during the lunch hour

**TP 1:00 PM – 1:45 PM**

**Intelligent Transformer Condition Monitoring**

Tony McGrail, Solutions Director, Asset Management & Monitoring Technology

**Doble Engineering Company**

In this presentation we will look at aspects of transformer condition monitoring - from the need to set goals and defining relevant monitoring parameters through to communicating of data/information and the need to have a predefined and agreed action plan. Intelligent condition monitoring can yield great benefits and we will discuss and present ways and means to achieve those benefits.

**Tony McGrail** is Doble Engineering Company's Solutions Director for Asset Management & Monitoring Technology, providing condition, criticality and risk analysis for utility companies. Previously Dr. McGrail has spent over 10 years with National Grid in the UK and the US; he has been both a substation equipment specialist, with a focus on power transformers, circuit breakers and integrated condition monitoring, and has also taken on the role of substation asset manager and distribution asset manager, identifying risks and opportunities for investment in an ageing infrastructure. Dr. McGrail is a Fellow of the IET, Chairman of the IET Council, a member of the IEEE, ASTM, CIGRE and the IAM, is currently on the executive committee of the Doble Client Committee on Asset and Maintenance Management, and a contributor to SFRA and other standards. His initial degree was in Physics, supplemented by an MS and a PhD in EE and an MBA. Dr. McGrail has a commitment to lifelong learning and is an Adjunct Professor at Worcester Polytechnic Institute, MA, leading courses in power systems analysis and distribution fundamentals.

**TP-A 1:00 PM – 1:45 PM**

**Transportation & Rigging**



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Andy Burns, Sales Manager  
Edwards Moving & Rigging

### DP 1:00 PM – 2:30 PM

**Differential Protection Application and Testing Procedures: : Basler 87T**  
Suparat “Poom” Pavavicharn, Senior Application Engineer  
Basler

### TP 1:45 PM – 2:30 PM

#### **Transformer Cooling Fundamentals**

Craig Stiegemeier, Director of Technology and Business Development  
**ABB Inc.**

Kevin Riley, Supplier & Product Development Manager  
**Trantech Radiator Products**

With temperature control being crucial in newer transformers, heat dissipation becomes very important. However, cooling system performance, with or without moving mechanical equipment, deteriorates with age. Even systems without oil-pumps or fans can fail due to weathering, rusting and fouling. How do we evaluate the health of the cooling system? Technology has improved with time, so what optimized solutions are available?

***Craig Stiegemeier** is the Director of Technology and Business Development for ABB’s North American Transformer Remanufacturing and Engineering Services (TRES) organization. He is responsible for developing effective processes supporting condition evaluation, assessment tools and life extension solutions for utility and industrial users of power transformers. Mr. Stiegemeier began his career 36 years ago as a development and design engineer for large shell-form transformers for Westinghouse in Muncie, Indiana. He also has project management experience for the US Navy as well as technical and commercial management for ABB’s transformer components business. He led the ABB TrafoStar winding production improvement processes and was commercial operations manager for the St. Louis power transformer operations before moving into transformer services in 2004.*

***Kevin Riley** is a Mechanical Engineer and certified Six Sigma Black Belt. He has been with Trantech Radiator Products for 7 years and is the Quality and Product Development Manager. Kevin has worked in the heat exchanger industry for over 10 years holding positions at Young Touchstone and Trantech within senior engineering and operations for products as diverse as Cuprobrazed, Fin and Tube and Plate Radiator technologies. Kevin has also worked with Electric Utility and Generation customers for over 12 years in the Fleet, Genset and T&D sectors. He currently works on cooling systems development and components with OEM and utility customers for new and replacement applications covering all types of transformers and equipment. Before beginning his career in the private sector with Caterpillar, Mr. Riley served as an officer in the United States Navy.*

### TP-A 1:45 PM – 2:30 PM

**High-Temperature, Liquid-Immersed Transformer Design using Advanced Materials**



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Jim McIver, Principal Applications Engineer  
Siemens

Use of advanced insulation materials allows high-temperature liquid immersed transformers to meet a variety of specialty applications. Requirements such as higher temperature operation, increased fire/flashpoint or biodegradable insulating fluids can be met with solid and liquid high-temperature materials. During this session we will look how these specialty transformers are designed, built, and tested. In addition, the standards and specifications needed to request high-temperature operation will be reviewed.

*Jim McIver has 40 years of experience in the North American electric power industry. Prior to Siemens' acquisition of VA Tech, he was VA Tech's Technology Director and now serves as Principal Application Engineer. While at Nevada Power, he managed design, procurement and maintenance of transformers, breakers and switchgear. As a GE Senior Application Engineer, he specified phase shifters, provided forensic analysis of transformer field failures and developed gas-in-oil diagnostics for sealed-tank, network transformers. Mr. McIver is member of Eta Kappa Nu, IEEE Transformer Committee, and is Professional Engineer in the State of New York. He earned his MSEE from Rensselaer Polytechnic and is a New York state registered P.E.*

**2:30 PM – 2:45 PM**

**Break**

**TP 2:45 PM – 4:15 PM**

**Load Tap Changer Fundamentals**

Bernhard Kurth, General Manager  
**Reinhausen Manufacturing, Inc.**

David Geibel, Engineering Manager  
**ABB Inc.**

Energized Load Tap Changers (LTCs), De-Energized (DETC), Transmission Class, Distribution Class, Resistive, Reactive, and so very much more. This is by far one of the most impressive presentations of the week, and it is jam-packed with information about history, usage, various designs, operations, maintenance, gas analysis, repairs, failures and components. Representatives of ABB and Reinhausen will be on hand to make presentations and then open the floor for discussion, and most importantly, to field your questions. This extremely practical presentation will allow the attendees to ask about all types of subjects related to the everyday operations, loading, and maintenance of transformer tap changers.

***Bernhard Kurth** was born in Quito, Ecuador on June 29, 1960. He received a M.S. degree in Electrical Engineering from Rhineland Westphalia Technical University at Aachen, Germany in 1987. Mr. Kurth has been around On-Load and Off-Circuit Tap Changers for his entire career. He has been President of Reinhausen Manufacturing in Humboldt, TN since its foundation in 1991. Before joining Reinhausen Manufacturing, Bernhard worked as Area*





# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

*Sales Manager at Maschinenfabrik Reinhausen GmbH in Regensburg, Germany, being then transferred as President of Reinhausen Canada Ltd. to Toronto, Canada in 1990.*

*David Geibel started out at General Electric Co. in Pittsfield MA over four decades ago and became a transformer components engineer. GE sold him to Westinghouse and Westinghouse sold him to ABB. Mr. Geibel has been the Engineering Manager for the ABB Alamo transformer components plant for about the past decade and have recently transitioned over to Technical Director. He graduated Magna Cum Laude from the University of Pittsburgh with a BSEE and holds several transformer components patents.*

**TP-A 2:45 PM – 3:30 PM**

**EMI Diagnostic Testing:**

**Electric Plant Reliability for HV Power & Industrial Sites**

James Timperley, Senior Principal Engineer

**Doble Engineering Company**

Since 1980 electromagnetic interference (EMI) Diagnostics has provided information on the electrical and mechanical condition of several thousand mission critical assets in power plants, heavy industry, petrochemical and marine locations. This on-line technique has been applied to many sizes and designs of generators, motors, transformers, switchgear, power cables and bus. This session provides case studies of electrical and mechanical deterioration identified with EMI Diagnostics. Several methods for data analysis are offered.

**DP 2:45 PM – 4:15 PM**

**Differential Protection Application and Testing Procedures: Beckwith M-3311A**

Steve Turner

**Beckwith Electric**

Numerical transformer differential relays require careful consideration for proper testing. These relays typically provide the following types of differential protection: restrained phase differential, high-set phase differential and restricted earth fault. Test categories cover a wide range such as verification of the manufacturer specified accuracy, power system simulation, field commissioning, maintenance and standards. It is also important to test differential protection to ensure the transformer is adequately protected for the actual application. This paper covers power system simulation testing to check the relay functionality and verify the accuracy of the protection. One such test case presented uses a simple power system model to calculate ground fault current at a fault close to the neutral of a wye connected winding; source strength and fault resistance are varied to determine the maximum sensitivity for restricted earth fault protection.

The paper presents test methods that are both simple to implement and practical: testing along the entire boundary of dual-slope phase differential operating characteristic and testing the directional element used to supervise restricted earth fault protection. Basic protection functions for transformer protection such as overexcitation are also presented.

*Steve Turner, IEEE Senior Member, is a Senior Applications Engineer at Beckwith Electric Company. His previous experience includes work as an application engineer with GEC Alstom, and an application engineer in the*



# Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA

international market for SEL, focusing on transmission line protection applications. Steve worked for Duke Energy (formerly Progress Energy), where he developed a patent for double-ended fault location on overhead transmission lines. Mr. Turner has a BSEE and MSEE from Virginia Tech. He has presented at numerous conferences including Georgia Tech Protective Relay Conference, Western Protective Relay Conference, ECNE and Doble User Groups, as well as various international conferences.

**TP-A 3:30 PM – 4:15 PM**      **Updated Iso-Phase Bus Inspection & Maintenance Best Practices**  
Gary Whitehead, Power Projects Specialist  
Electrical Builders Inc.

This presentation will review best practices for analysis, inspection, cleaning and maintenance of the bus duct systems of the power generation facility. Many plant operations and maintenance managers ignore the bus duct system, forgetting it is a system critical component in the power plant that does not have redundancy AND is connected to expensive plant assets on both ends. The presentation will review numerous case studies from more than forty years of field.

**Gary Whitehead** is the Power Projects Specialist at Electrical Builders Inc. (EBI). Since coming to EBI his main focus has been working on projects such as new installation, retrofits as well as design improvements and value engineering on existing systems. Mr. Whitehead has attended numerous colleges studying industrial and architectural drafting and design. He has over 7 years of experience in this industry working for AZZ/Calvert, a designer and manufacturer of Iso-Phase systems as an Engineering Technical Coordinator and also in their Installation Services as a Designer/Quotation Specialist and Project Manager.

**TP & DP 4:15 PM – 5:15 PM**      **Heavy Equipment Demonstrations**  
Join ABB, Delta Star, GE and Siemens for demonstrations of their heavy equipment.

**5:30 PM – 8:00 PM**      **Industry Expo & Reception**

## Wednesday, February 22, 2017

**6:00 AM – 6:00 PM**      **Registration & Information Desk Open**

**6:00 AM – 8:00 AM**      **Attendee Breakfast**

**TM 7:00 AM – 8:00 AM**      **What's in the Box?**  
*(Designed for 3-Day Transformer Maintenance Program Seminar Attendees)*



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Troy Kabrich, Vice President & General Manager – Services Division  
**SPX Transformer Solutions, Inc.**

Power transformers demand a higher degree of care during installation. The large investment in the transformers and their importance to the power system demonstrates the need for careful field preparation for service. This presentation will highlight recommendations for the proper receipt, inspection, field assembly, oil processing, and acceptance testing of large liquid immersed power transformers rated 10 MVA or greater or with high voltage windings rated 69 kV and above. Basic transformer field installation topics and standards will be reviewed to include inspections, equipment requirements, assembly and field dry out techniques, determination of insulation moisture concentration, provisions for cold ambient temperature processing, vacuum filling processes, and acceptance testing.

***Troy Kabrich** is currently the Vice President & General Manager for the Goldsboro, NC Manufacturing Plant and the Service and Components Division of SPX Transformer Solutions, Inc. During his twenty-five years of industry experience, Mr. Kabrich has held positions as a Plant Manager, Director of Field Services, Repair Operations Manager, Field Service Engineer, and Sales Engineer. He has published articles for T&D World and Utility Automation and Engineering magazines, was author of Installation and Maintenance Chapter of Third Revision of the Electric Power Transformer Engineering Handbook, and is a frequent contributor to industry training programs. Troy has a Bachelor of Science degree in electrical engineering from Rose-Hulman Institute of Technology.*

**TP 8:00 AM – 8:45 AM**

### **Insulating Fluid Basics & How to Take a Proper Oil Sample**

Lance Lewand, Director Insulating Materials Laboratories  
**Doble Engineering Company**

**TP-A 8:00 AM – 8:45 AM**

### **High Voltage Withstand Testing**

Tom Melle, Manager  
**HighVolt**

Gilbert Lemos, Manager – Apparatus and Maintenance Technical Support  
**Southern California Edison**

Southern California Edison has been proactively replacing old and unreliable extra high voltage (EHV) transformers within our service territory over the past several years. All new transformers are now coming from manufacturers based overseas. Consequently, these transformers are more susceptible to damage caused by extra handling, including on and off-loading at docks, traveling over-seas, railcar or truck, and off-loading at final destination. At any point along the way, this handling exposes transformers to possible damage. In addition, the introduction of localized conductive contamination is possible during disassembly at the factory or assembly at the final destination. As a result, this damage or contamination may not be detected through internal inspection or routine acceptance testing. Since 2006, Southern California Edison has implemented field induced testing with partial discharge (PD) measuring equipment as a final check to ensure the integrity of the transformer



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

before placing in service. This paper illustrates the benefits of performing field induced testing utilizing various PD detection methods to identify insulation issues, including the drivers which lead to performing this additional test in the field. In addition, several supporting case studies will be illustrated.

**Gilbert Lemos** has been employed at Southern California Edison since 1980. Currently is Manager of Apparatus and Maintenance Technical Support group in Substation, Construction, and Maintenance Department. Prior to this position, he performed and supervised all factory-type transformer test activities for both large and small power transformers for most of his career in the transformer repair facility in Westminster, California for SCE. He has a BA from the University of La Verne.

**DP 8:00 AM – 8:45 AM**

**Case Study: Implementing IEC 61850 Substation Automation Standard**

Devin Kaufman, Technical Specialist  
SCE

**TP 8:45 AM – 10:15 AM**

**Transformer Assembly, Oil Processing & Commissioning**

Troy Kabrich, Vice President & General Manager – Services Division  
SPX Transformer Solutions, Inc.

Steve Larson, Manager, Substation Construction & Maintenance  
Snohomish Public Utility District

This presentation will highlight recommendations for the proper receipt, inspection, field assembly, oil processing, and acceptance testing of large liquid immersed power transformers. Transformer field installation processes and standards will be reviewed to include impact recorders, equipment requirements, assembly operations, field dry out techniques, determination of insulation moisture concentration, provisions for cold ambient temperature processing, vacuum filling processes, and acceptance testing.

**Troy Kabrich** is currently the Vice President & General Manager for the Goldsboro, NC Manufacturing Plant and the Service and Components Division of SPX Transformer Solutions, Inc. During his twenty-five years of industry experience, Mr. Kabrich has held positions as a Plant Manager, Director of Field Services, Repair Operations Manager, Field Service Engineer, and Sales Engineer. He has published articles for T&D World and Utility Automation and Engineering magazines, was author of Installation and Maintenance Chapter of Third Revision of the Electric Power Transformer Engineering Handbook, and is a frequent contributor to industry training programs. Troy has a Bachelor of Science degree in electrical engineering from Rose-Hulman Institute of Technology.

**Steve Larson** is Manager of Substation Construction and Maintenance at Snohomish County Public Utility District. He has a Master's degree in Electrical Engineering from University of Colorado and is a licensed Professional Engineer in Washington state. Steve is a Senior Member of IEEE, former Doble Circuit Breakers committee chairman, and is currently the Vice-Chairman of the Doble Advisory committee.





# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

**TP-A 8:45 AM – 9:30 AM**

### Transformer Design Reviews

Bill Griesacker, Principal Engineer, Consulting and Testing Services  
**Doble Engineering Company**

An effective procurement system utilizes the preapproval process to identify suitable power transformer vendors and a design review to establish an agreed upon design and procurement process. This preapproval approval process should include factory qualification audits which are essential to confirm a manufacturer's ability to meet a purchaser's requirements and expectations. The design review is performed to establish an agreed upon design and to facilitate the procurement process. That the supplier is capable of meeting the purchaser's procurement specifications is confirmed during this process and the procurement process is expedited by bringing the purchaser and supplier together on the technical details of the purchased transformer.

**Bill Griesacker** is a member of Doble Engineering Company as a transformer engineer working on projects that include factory inspections, condition assessment, design reviews, failure analysis and general consulting. He previously worked for Pennsylvania Transformer Technology Inc., where he held various positions including Engineering Manager. His work included high voltage insulation design, transient voltage modeling of power transformer windings and various LTC and DETC switch development projects. Prior to this, he was employed by the Westinghouse Electric Company, working on synchronous generator projects as a member of the Generator Engineering Department. Mr. Griesacker started his career with Cooper Power Systems in large power transformers and later worked in the Kyle Switchgear, Vacuum Interrupter Department. He has earned a MS in electric power engineering from the Rensselaer Polytechnic Institute and a BS in electrical engineering from Gannon University. Mr. Griesacker is an active member of the IEEE.

**DP 8:45 AM – 10:15 AM**

### Transformer Differential Protection Issues & Solutions:

**ERLPhase T-Pro**

Krish Narendra, Chief Technical Officer

**ERLPhase Power Technologies Ltd.**

Traditionally, differential protection is in use to protect power transformers as primary protection. Percentage differential characteristics is the basic principle used with classical two slopes settings. This presentation discusses the issues with the percentage differential principles and solutions using different principles as supervisory and /or alternative method to make the differential protection more secure and reliable.

**Dr. Krish Narendra** has over 25 years of experience in power system protection, monitoring, control and analysis. He is responsible for innovative design, implementation, quality and commercialization of protective relays and disturbance monitoring recorders using advanced digital signal processing technologies on embedded systems, and in Windows development environments. He worked as a Research Assistant (Post-Doctoral Fellow) at Concordia University in Montreal, Canada in 1995 and 1996. In 1986 he obtained a BE (Electrical Engineering) from the University Visweswaraiyah College of Engineering (UVCE), and an MSc (EE) and PhD (EE) with a specialization in High Voltage Engineering from the Indian Institute of Science in India in 1989 and 1993





# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

respectively.

*Dr. Narendra has been a valued IEEE member for over 15 years. He is actively participating in the IEEE PRSC working groups, and is a member of the PRTT of NASPI. He is a member of the CIGRE C4-B5 working group and NERC SMS committee. He has published over 35 papers in various IEEE/IEC journals and conferences, and is an innovator of several patents.*

**TP-A 9:30 AM – 10:15 AM**     **Asset Health and Criticality within an Aging Transformer Infrastructure**  
Carl Kapes, Manager – Transmission & Substation Reliability  
**Pepco Holdings, An Exelon Company**

**ALL 10:15 AM – 10:45 AM**     **Break & Heavy Equipment Demonstrations**  
*Opportunity to visit our exhibitors with large vehicles on display: ABB, Delta Star, GE & Siemens*

**ALL 10:45 AM – 12:15 AM**     **Transformer Field Testing**  
Robert Brusetti, Director, Client Service Engineering  
**Doble Engineering Company**

Financial implications and complex of the asset are the primary reasons power transformers are viewed as the most critical component in the electric power system. Field-testing provides the engineer with a group of tools to assess the condition of the transformer and to identify problems and the level of criticality. Each test provides data to support decisions about transformer. The early detection of problems can minimize the repairs involved and mitigate catastrophic failures. The scope of this presentation is to consolidate all the current techniques for field testing transformers and identify each test's true capability.

**Robert Brusetti** received his BS in Electrical Engineer degree from the University of Vermont in 1984 and a MBA from Boston College in 1988. He has been employed at Doble Engineering Company for twenty years and currently serves as Director of Client Service Engineering. Prior to his present responsibility he has held positions as Product Manager and Field Engineer. Mr. Brusetti is a licensed Professional Engineer in the state of Massachusetts.

**12:15 PM – 2:15 PM**     **Industry Expo & Lunch**  
**Heavy Equipment on Display:** ABB, Delta Star, GE and Siemens heavy equipment will be on display during the expo lunch period

**TP 2:15 PM – 3:00 PM**     **Transformer Oil Processing & Field Vacuum Dry-out**  
Greg Steeves, General Manager  
**Baron USA, LLC**



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Transformer life depends mainly on the condition of the liquid & solid insulation. The liquid insulation can be maintained and restored with purification & reclamation. The solid insulation however is difficult to maintain directly. Various technologies and techniques are available to maintain the insulation (both directly & indirectly). Appropriate selection and application of transformer dry-out technologies and techniques can extend transformer life, reduce downtime and save money. These technologies and their field applications will be discussed during this presentation.

**Greg Steeves** is General Manager and principle engineer of Baron USA, LLC. Baron is the premier provider of transformer dry-out and dielectric fluid processing systems for OEM's, utilities and field service organizations worldwide. Mr. Steeves joined Baron USA as Engineering Manager in 1987. He is currently responsible for managing the daily operations and overseeing the application, engineering design and manufacturing of oil purification equipment, vacuum chambers, vapor phase processing and transformer dry-out equipment. He earned his degree in Mechanical Engineering from Tennessee Technological University and is licensed in the state of Tennessee.

**TP-A** 2:15 PM – 3:00 PM

### Internal Inspection

Kirk Robbins, Senior Staff Engineer  
Steve Moorhead, Senior Project Manager  
**Exelon**

**DP** 2:15 PM – 3:45 PM

### Differential Protection Application and Testing Procedures:

**GE T90**  
Terrence Smith  
**GE**

**TP** 3:00 PM – 5:00 PM

### Focus Group: Transformer Life-Extension & Maintenance Solutions for Improved Reliability

#### Part 1: Transformer Maintenance Frequency Intervals

Rick Youngblood, Consultant

#### Part 2: On-site Major Core Rewinds/Repairs

Mark Borba, Regional Sales Manager

**GE Energy Connections**

#### Part 3: Bushing Changeouts

Juan Acosta

**Siemens**

One vital component that is commonly replaced during a transformer's lifetime is the bushing. Bushings may require replacement due to reasons



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

such as electrical issues, physical damage, unsatisfactory DGA when oil filled, leaks, and reasons related to the bushings manufacture and design. Presentation will cover key aspects to considering when replacing bushings.

***Juan Acosta** manages the Transformer Lifecycle Management business for Siemens in the US. He is responsible for providing leadership to the applications engineering team to successfully grow the Power Transformer Service portfolio. Acosta joined Siemens in 2004 and has held positions in the strategic planning, manufacturing, continuous improvement and service of transformers with Siemens in Europe, North America and South America. Juan has a BS in Mechanical Engineering, MBA and is a licensed PMP.*

#### **Part 4: Cooling System Maintenance & Upgrades**

Jeff Cooper

**Unifin**

#### **Part 5: LTC Retrofits**

Craig Stiegemeier, Director of Technology and Business Development  
**ABB Inc.**

#### **Part 6: Ester Transformer Retrofills**

Larry Christodoulou, Southeast Regional Director

**Electric Power Systems**

This paper will discuss the retro fill of two oil-filled power transformers which are over forty years old with a natural-based ester fluid known as FR3™. The advantages in using FR3™ as a replacement fluid in a mineral oil transformer will be reviewed along with any negative concerns. Procedures for draining existing mineral oil, flushing internal tank core and coil assembly, vacuum filling and final electrical testing will be covered in this paper.

**AT 3:00 PM – 5:00 PM**

#### **Advanced Insulating Fluid Topics**

##### **Part 1: Isoparaffinic Transformer Oils**

Chris Armstrong, Sr. Technical Services Advisor

**Petro-Canada Lubricants Inc.**

Catalytic dewaxing technology has led to the development of isoparaffinic transformer oils with desirable physical and chemical properties. Severe refining processes produce isoparaffinic oil that has excellent additive



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

response and is virtually corrosive-sulphur free. These properties make isoparaffinic base oils ideally suited for transformer oil applications in various operating environments. The technologies available for the production of isoparaffinic transformer oils will be discussed in this presentation, with an emphasis on factors that have led to technological improvements in the industry.

**Chris Armstrong** is a Sr. Technical Services Advisor for Petro-Canada Lubricants' Luminol Transformer Fluid product line. He has worked for Petro-Canada for over 22 years and has held positions in Refinery Operations, Research & Development, Sales and Technical Services. Currently as a Sr. Technical Services Advisor, he is a voting member of ASTM Committee D27 on Electrical Insulating Liquids and Gases. He holds a Material Engineering Technology diploma from Mohawk College and his CLS certification from the STLE.

**Part 2: Naphthenic Mineral Insulating Oil Manufacture, Additives & Storage**  
Jimmy Rasco, Vice President – Global Base Oil Technology  
**Ergon, Inc.**

This portion of the panel will cover Naphthenic Mineral Insulating Oil Manufacturing, Additives and Storage. Naphthenic oils have been used as transformer insulating oil successfully for many years. They have heat transfer and low temperature properties that make them well suited for this application. This paper will review some history of naphthenics use as insulating oil and manufacturing processes that refiners employ to produce them. It will review how refining impacts the type, quality and performance of the oils in transformers along with different additives that can impact performance. It will also look at transformer oil is stored to ensure its integrity for delivery.

**Jimmy Rasco** has responsibility for quality and development of naphthenic and paraffinic base oils. He has worked with Ergon for 22 years and has 42 years of experience in Quality Control and Technical Support of petroleum refined products. He has a BS degree in Chemistry from Alcorn State University and is a member of the American Chemical Society, CIGRE, IEEE, IEC, ANSI TAG to IEC TC 10 and ASTM where he serves as Chairman of Subcommittee 27.01 for Mineral Oil. He has served on numerous Maintenance Teams and Working Groups for International organizations governing transformer oil.

**Part 3: Synthetic Esters**



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Russell Martin, Chief Technical Manager  
**M&I Materials**

Synthetic ester-based fluid has been used for nearly four decades in a myriad of different transformer and non-transformer applications due to its robust nature. This fluid can be used in almost every type of transformer, from distribution to large power, breathing, sealed and high temperature. It stands up to the most rigorous conditions and has a proven track record in applications such as compact rolling stock transformers.

***Dr. Russell Martin** is the Chief Technical Manager for Dielectric Fluids at M&I Materials, Manchester, where he leads the Technical Development and Application Innovations for ester transformer fluids. He holds a PhD in Chemistry and is a Fellow of the Royal Society of Chemistry. He contributes to various CIGRE, IEEE, ASTM, IEC and BSI technical & standard groups and was awarded the CIGRE technical Committee Award for outstanding contribution by the A2 (Transformer) division in 2010, and the IEC 1906 Award in (2011) for updating the standard IEC 61099 (Synthetic Esters for Electrical Purposes).*

### **Part 4: Natural esters based liquids for in service transformer: in-service performance and process of treatment, reconditioning and reclaiming**

Alan Sbravati, Dielectric Fluids Specialist  
**Cargill Industrial Specialties**

As the quantity and age of natural ester filled transformers grows, demand for field service, fluid treatment and transformer maintenance are expected to be generated. The behavior of in service transformers filled with natural ester liquids will be presented in this article, for discussion of the overall performance and estimation of time to reach the continuous operation limits. Instances where variation of the dielectric liquid properties requires a treatment and the situations caused by abnormal operation conditions will as well as the reclaiming process and results will also be discussed

***Alan Sbravati** was born in Brazil, in 1979. He acts as specialist on dielectric liquids application with Cargill Industrial Specialties. He holds a B.Sc. in Mechanical Engineering from the UNICAMP in Brazil, a MBA from FGV/São Paulo and a Master Degree from ILEDE/Pittsburgh University. Having started his career in power transformer manufacturer, he has large experience in design, calculation, testing, installation and assessment of power transformers. He is currently chairman of Brazilian committee for Power*





# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

*Transformers, active in Cigre working groups and IEEE Transformer Committee.*

**DP 3:45 PM – 5:00 PM**

**Differential Protection Application and Testing Procedures:**

**Siemens 7UT**

Roy Moxley

**Siemens**

Differential protection is recognized as a fast, sensitive, and selective way to protect many types of system assets. Changes in transformer construction have complicated differential protection. This presentation discusses the latest methods to improve protection speed and security. Tradeoffs and benefits are discussed along with real-world case studies.

**ALL 5:00 PM – 5:30 PM**

**Ask the Experts Panel**

**6:00 PM – 10:00 PM**

***Social Event at the Lyon Air Museum***

*Seminar sponsors A-Line, Delta Star, Edwards Moving & Rigging, Electrical Builders Inc., Siemens and Doble invite seminar attendees to the Lyon Air Museum to see airplanes, cars, motorcycles and World War II memorabilia and artifacts and enjoy cocktails and dinner.*

## **Thursday, February 23, 2017**

**7:00 AM – 6:00 PM**

***Registration & Information Desk Open***

**7:00 AM – 8:00 AM**

***Attendee Breakfast***

**TP 8:00 AM – 8:45 AM**

**Transformer Asset Health Indexing & Fleet Management**

Paul Griffin, Vice President Global Professional Services

**Doble Engineering Company**

Kurt Schamburg, Transformer Program Manager

**Calpine Corporation**

**TP-A 8:00 AM – 8:45 AM**

**Factory Repair**

Mark Borba, Regional Sales Manager

**GE Energy Connections**



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

**DP 8:00 AM – 9:45 AM**

**Differential Protection Application and Testing Procedures: SEL 487**

Karl Zimmerman  
**SEL**

**TP 8:45 AM - 9:45 AM**

**Calculating Probability of Failure (POF) for Transmission Assets: Challenges and Methodology**

G. Matthew Kennedy, Solution Director, Enterprise & Data Technology  
**Doble Engineering Company**

*G. Matthew Kennedy is Doble Engineering Company's Solutions Director: Enterprise and Data Technology, overseeing the complete software and cloud product vision of the company. During his time at Doble, Mr. Kennedy has had leading roles in the innovation and development of products such as the M-Series (M4, M5, M7), DTA, dobleARMS™ and dobleDATABASE™. With a keen interest in diagnostic technology, Mr. Kennedy has authored diagnostic analysis sections for international standards in addition to numerous papers, journal and magazine articles for the power industry. He holds a BS in Electrical Engineering from the University of California, Santa Barbara where he studied signal and digital signal processing. His post graduate studies continued with the US Navy: Nuclear Power School, University of Idaho in Electrical Power Engineering and Cornell University in Product Design and Development. He is a member of IEEE, IEC, USNC, and ISO.*

**TP-A 8:45 AM – 9:45 AM**

**LTC Maintenance Requirements and Steps for In-Tank LTC**

Bernhard Kurth, General Manager  
Paul Shuttleworth, Senior Area Sales Manager  
**Reinhausen Manufacturing Inc.**

*Bernhard Kurth was born in Quito, Ecuador on June 29, 1960. He received a M.S. degree in Electrical Engineering from Rhineland Westphalia Technical University at Aachen, Germany in 1987 and has been around On-Load and Off-Circuit Tap Changers for his entire career. He has been President of Reinhausen Manufacturing in Humboldt, TN since its foundation in 1991. Before joining Reinhausen Manufacturing, Mr. Kurth worked as Area Sales Manager at Maschinenfabrik Reinhausen GmbH in Regensburg, Germany, being then transferred as President of Reinhausen Canada Ltd. to Toronto, Canada in 1990.*

**9:45 AM – 10:00 AM**

**Break**

**TP 10:00 AM – 10:45 AM**

**Strategies for Transformer Replacement Prioritization**

Alex Salinas, Principal Manager  
**Southern California Edison**

**TP-A 10:00 AM – 10:45 AM**

**Commonly Overlooked Maintenance Items**

Rick Youngblood, Consultant



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Maintenance is a widely varying topic when it comes to transformers. The common list of items typically performed cover 90% of all transformers but it's the 10% of the items overlooked that can have the same catastrophic consequences. This paper is intended to make the reader think about the lesser maintained items and add them into the list of regularly performed maintenance and test tasks.

***Rick Youngblood's** engineering career spans more than three decades. After leaving active duty from the Air Force he joined Cinergy Corporation (then known as Public Service of Indiana) as an entry level engineer. After receiving his BSEE from Purdue University he was promoted to Project Engineer and then Manager of Technical Services in their Northern Division responsible for construction, maintenance and metering. After merging with Cincinnati Gas and Electric and forming Cinergy Corporation, Mr. Youngblood became Senior Engineer responsible for implementing their CMM System "Maximo" and developing their condition-based maintenance program. He went on to become Supervising Engineer for Substation Services. In 2004 Mr. Youngblood joined American Electrical Testing Company as Regional Manager of their Midwest office. He obtained his NETA 3 certification and went on to perform maintenance and testing in utility and industrial environments. He joined Doble Engineering Company in 2010 as Principal Engineer in the Client Service group and remained at Doble until his retirement in 2015. Mr. Youngblood is currently a consultant.*

**DP 10:00 AM – 12:00 PM**

### LTC Controls & the Basics of Transformer Paralleling

Steve Larson, Manager, Substation Const. & Maintenance  
Snohomish Public Utility District

Dr. Murty Yalla, President  
Beckwith Electric

Steve Averitt, Senior Area Sales Manager - Automation & Control  
Reinhausen Manufacturing

This presentation covers basic concepts of transformer parallel operations (including impact on LTCs). Several hardware/software solution providers will then present their implementation to accomplish effective, safe transformer paralleling (including effects & mitigation of LTC operations).

***Steve Larson** is Manager of Substation Construction and Maintenance at Snohomish County Public Utility District. He has a Master's degree in Electrical Engineering from University of Colorado and is a licensed Professional Engineer in Washington state. Steve is a Senior Member of IEEE, former Doble Circuit Breakers committee chairman, and is currently the Vice-Chairman of the Doble Advisory committee.*



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

*Dr. Murty Yalla has been with Beckwith Electric Company since 1989 and presently holds the position of President. Dr. Yalla has a Ph.D. in Electrical Engineering from the University of New Brunswick, Canada. He has published several research papers in international journals on digital protection and holds five U.S. patents in digital controls and protective relays. He is the chairman of the International Electrotechnical Commission (IEC, Geneva, Switzerland) Technical Committee 95, a U.S. delegate to the International council on large electric systems (CIGRE) and a member and subject matter expert of the North American Electric Reliability Corporation (NERC) System Protection and Control Subcommittee (SPCS). Additionally Dr. Yalla was a past Chairman of the Rotating Machinery Protection Subcommittee. Presently he is secretary of the IEEE Power System Relaying and Control (PSRC) committee. He serves as chairman of several working groups which developed IEEE standards, tutorials and technical reports. He was the organizer of the IEEE PES Tutorial on Distribution volt var control and optimization which was presented during the July 2016 PES general meeting in Boston. Dr. Yalla was elected to IEEE Fellow in 2006. He received the IEEE Florida Council Outstanding Engineer Award in 2005, and the IEC 1906 Award in 2010 which honors the IEC experts around the world.*

**TP 10:45 AM – 12:00 PM**

### **Forensic Analysis**

#### **Part 1: Root Causes of Failures**

Bill Griesacker, Principal Engineer, Consulting and Testing Services  
**Doble Engineering Company**

Forensic examinations are conducted for a number of reasons; however, the end goal is typically to determine the root cause of the failure. Often this examination involves the review of historical operating conditions prior to the failure and the disassembly of the failed transformer in search of supporting evidence. Case studies will be presented.

*Bill Griesacker is a member of Doble Engineering Company as a transformer engineer working on projects that include factory inspections, condition assessment, design reviews, failure analysis and general consulting. Mr. Griesacker holds an MS in electric power engineering from the Rensselaer Polytechnic Institute and a BS in electrical engineering from Gannon University. He is an active member of the IEEE, PES Transformers Committee where he holds positions in several working groups and subcommittees.*

#### **Part 2: Forensic Decommissioning**

Anne Bailey, Sales Manager  
**A-Line E.D.S.**



# Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA

Each transformer recycling project is unique based on the transformer design, location and circumstances for removal. This presentation will provide project examples to showcase on-site removal options and expectations as well as showcase the specialized equipment available to aide in the detailed assessment of power transformers. Project examples will include premature transformer failure assessment as well as procedures for obtaining samples during routine transformer replacement projects to aide in condition assessment initiatives.

***Anne Bailey** has been with A-Line E.D.S. managing transformer recycling projects for the past 10 years. She has experience contracting, evaluating and managing on-site transformer dismantling projects to provide turnkey services including the safe and environmentally sound disposal of power transformers including specialty services for forensic decommissioning.*

### Part 3: Case Studies

**TP-A 10:45 AM – 12:00 PM** **LTC Maintenance & Extending Maintenance Cycles**  
Jim McLean, Director of LTC Business  
**North American Substation Services**

This presentation is centered on the maintenance of LTCs and what you can do to aid in extending your maintenance cycles. It will cover items such as; filtration, coke formations, contact upgrades, contact alignment and understanding your LTCs needs.

***Jim McLean** is the Director of LTC Business for North American Substation Services LLC. He has held key positions in the service, sales and marketing areas for Reinhausen Manufacturing and Waukesha Electric Systems. He has 30 years of experience in the service and support of manufacturing, maintenance and field operations. He has 16 years of experience in Field Service Management. He has traveled the United States, Canada, The Caribbean and Europe as a computer programmer specializing in interface and communications. He is a training class developer and instructor for LTC training classes where he has instructed over 120 classes and 950 students across the United States and Canada. He has traveled to Venezuela to lead in a LTC failure analysis. Jim enjoys working with youth sports and teaching proper techniques for football and basketball. He is the past President, V President and Senior Division V President for Medina Football & Cheerleading League where he lead in the activities of 12 youth league football and cheerleading teams. He has been a head basketball coach with the Boys & Girls Club of America in North Carolina. He is an active board member of the local high school athletic booster club. Jim is originally from North Carolina where he attended both Central Piedmont Community College and Gaston College.*

**12:00 PM – 1:00 PM**

**Lunch**





# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

**TP 1:00 PM – 1:45 PM**

### **Measuring and Locating Partial Discharge in Transformer in Service**

Falk Werner, Sr. Field Engineer

**Doble Engineering Company**

Subject of the presentation is a transformer fleet PD assessment performed in the Caribbean in 2015. Measurement approaches and findings are laid out covering HFCT, RFI and acoustic PD testing. As a result of the assessment a transformer with defective cable L-bows was identified. In order to prevent failure of the equipment, those L-bows were inspected and significant deterioration was found within the connection.

**Falk Werner** studied Electronics and Information Technology with a focus on Telecommunication and Signal Processing at the University of Stuttgart in Germany. His final thesis was *Location of Partial Discharges by Means of Sensor Arrays*. Mr. Werner has in-depth knowledge of partial discharge (PD) diagnostics and measurement methods on high voltage insulation systems. At Doble Lemke in Germany he co-developed the PD solutions range. Mr. Werner has several publications to his credit and is currently a Doble Power Services Engineer at Doble Engineering Company focusing on partial discharge, diagnostics and solution development.

**TP-A 1:00 PM – 2:45 PM**

### **Establishing a Transformer Life-Cycle Maintenance Program**

Tony McGrail, Solutions Director, Asset Management & Monitoring Technology

**Doble Engineering Company**

In today's modern utility, capital investments in transformers and other T&D assets can be on the order of billions of dollars. With all that spending, there is enormous pressure to implement optimized, intelligent substation maintenance program including creating maintenance & life cycle planning policies to ensure that we are making the right decisions with regard to managing risk and ensuring the reliability of our system. Expected program goals include reduction/optimization of substation asset maintenance costs, overall asset life-cycle cost optimization and maintenance resource optimization. Many utilities today however still successfully operates on a time-based approach that doesn't correspond with asset health or criticality and is adjusted periodically based on newer fault history, personnel availability and budget availability.

This session will discuss:

- Setting up an effective transformer maintenance management model
- Optimizing maintenance and inspection decisions
- Asset health indexing
- Optimizing repair, refurbishment and replacement decisions
- Design & implementation of required data management and IT decision support tools
- Assembling, presenting and justifying the optimal transformer maintenance management plan



# Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA

**Tony McGrail** is Doble Engineering Company's Solutions Director for Asset Management & Monitoring Technology, providing condition, criticality and risk analysis for utility companies. Previously Dr. McGrail has spent over 10 years with National Grid in the UK and the US; he has been both a substation equipment specialist, with a focus on power transformers, circuit breakers and integrated condition monitoring, and has also taken on the role of substation asset manager and distribution asset manager, identifying risks and opportunities for investment in an ageing infrastructure. Dr. McGrail is a Fellow of the IET, Chairman of the IET Council, a member of the IEEE, ASTM, CIGRE and the IAM, is currently on the executive committee of the Doble Client Committee on Asset and Maintenance Management, and a contributor to SFRA and other standards. His initial degree was in Physics, supplemented by an MS and a PhD in EE and an MBA. Dr. McGrail has a commitment to lifelong learning and is an Adjunct Professor at Worcester Polytechnic Institute, MA, leading courses in power systems analysis and distribution fundamentals.

**DP 1:00 PM – 1:45 PM**

### Automated Protection Data Management

Joe Stevenson, Sales Manager  
Enoserve, a Division of Doble

Protection system data management is complex. Relay professionals operate with numerous and varied data sources between the office and field. This discussion highlights some common struggles of the typical power company in managing protection system information and presents a useful, how-to approach for automating relay data management with solutions available from Doble.

**Joe Stevenson** has worked in technical consultative sales in the electric power industry for the past 14 years during his career at ENOSERV, a Division of Doble. In his tenure, he has worked primarily with relay professionals who are directly involved with system protection and regulatory compliance from entities spanning all industry segments. On countless occasions he has been involved with matters pertaining to system integrations and data-related process improvements for customers.

**TP 1:45 PM – 2:45 PM**

### Developing Diagnostic Strategies through Understanding Field Test Results – Part I

Mark Lachman, Director of Diagnostic Analyses  
Robert Brusetti, Director, Client Service Engineering  
Doble Engineering Company

**Mark F. Lachman, Ph.D., P.E.**, has been with the power industry for over 30 years. In 2005, he joined Delta Star in San Carlos, CA, where, as Test Manager, he was responsible for the test department operation. In 2011, he returned to Doble Engineering Company as Director of Diagnostic Analyses.

**Robert Brusetti** received his BS in Electrical Engineer degree from the University of Vermont in 1984 and a MBA from Boston College in 1988. He has been employed at Doble Engineering Company for twenty years and currently serves as Director of Client Service Engineering. Prior to his present responsibility he has held positions



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## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

as Product Manager and Field Engineer. Mr. Brusetti is a licensed Professional Engineer in the state of Massachusetts.

**DP 1:45 PM – 2:45 PM**

**Overview and Features of Doble Protection Suite Software – Part I**

Ed Khan, Director of Protection Training

**Doble Engineering Company**

*Ed Khan has been with Doble for more than 6 years working in various capacities including product manager for protection tested related instruments. Prior to Doble, Mr. Khan has worked for GE, ABB, SEL, KEMA and others in various capacities. He has over 30 years of experience in system studies, protection applications, relay design, power plant design, teaching and product management. He has a thorough knowledge about product development, protection, harmonic analysis, harmonic filter design, stability studies, Real Time Digital Simulations, generator protection and more. He has presented courses on behalf of Doble globally and has been an invited speaker for utilities and industrial customers in Southeast Asia, Middle East, Mexico, India and China. He is a member of CIGRE working group B56.5 focusing on the optimization of protection and controls.*

**2:45 PM – 3:00 PM**

*Break*

**TP 3:00 PM – 4:45 PM**

**Developing Diagnostic Strategies through Understanding Field Test Results – Part II**

Mark Lachman, Director of Diagnostic Analyses

Robert Brusetti, Director, Client Service Engineering

**Doble Engineering Company**

**TP-A 3:00 PM - 4:45 PM**

**Assembling and Justifying the Optimal Strategic Asset Management Plan**

Peter Jay, Principal Consultant

**Woodhouse Partnership Ltd.**

Managing aging assets is one of the most critical issues facing utilities struggling with competing priorities, constrained resources, a challenging regulatory environment and the difficulty of determining which projects, maintenance or asset replacement tasks are really worthwhile and when. The newly published ISO 55000 “Standard on Asset Management” provides an excellent framework within which to manage assets proactively and create organizational value. Good asset management decision making requires a clear understanding of the objectives, a consistent and disciplined process, ability to identify relevant facts and correctly evaluating options and alternatives for their benefits, cost, risks and asset life cycle impact.

This session will discuss:

- What is asset management
- Risk-based decision making



# Life of a Transformer™ Seminar

## Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

- Case studies in electric utility life-cycle asset management
- Assembling, presenting and justifying the optimal strategic asset management plan

**DP 3:00 PM – 4:45 PM**

**Overview and Features of Doble Protection Suite Software – Part II**

Ed Khan, Director of Protection Training

**Doble Engineering Company**

**ALL 4:45 PM – 5:30 PM**

**Ask the Experts Panel – Anything Transformer Related**

### **OPTIONAL LABORATORY SEMINAR**

**Friday, February 24, 2017**

*7:00 AM – 8:00 AM*

*Attendee Breakfast*

*7:00 AM – 4:30 PM*

*Registration & Information Desk Open*

**LS &**

**TM 8:00 AM – 4:30 PM**

**Transformer Condition Assessment Using Laboratory Diagnostics**

Paul Griffin, Vice President Global Professional Services

Lance Lewand, Director Insulating Materials Laboratories

**Doble Engineering Company**

This one-day session provides students with a thorough understanding of how to assess the condition of electrical insulating materials and transformers.

*Dissolved gas-in-oil analysis* – This is the single most important diagnostic test for transformers. This presentation reviews how the test is performed, how to distinguish between normal gassing behavior and problems, and how to evaluate trends. Practical case studies and examples are used to illustrate theoretical concepts. Seminar participants will be quizzed (with class participation) on their understanding in diagnosing 12 cases.

*Water in Transformer Oil* – Assessing how dry a transformer is requires more than a water in oil test. Learn how to assess the wetness of the transformer insulation system and why you need to know the operating temperature at the time of sampling. This session discusses water migration in transformers and how water affects the ability to overload them. Examples are provided.

*Condition assessment of cellulosic insulation* – The analysis of the condition of the paper insulation has changed quite a bit in the past 10 years. Learn how the solid insulation ages and how to assess the condition of the paper



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February 20-24, 2017 | Huntington Beach, California USA

and pressboard insulation and its remaining life. Case studies are given to illustrate the distribution of paper aging in transformers and how operation and maintenance can influence it.

*Metals in oil* – This presentation provides an understanding of the importance of metal-in-oil tests as a diagnostic. To be able to use the information, the correct test must be specified – learn the difference between dissolved and particulate metals and when to choose each test. Case studies are given.

*Quality of new and service aged oils* – Background information is provided on the properties of transformer oil. The presentation includes how to specify and evaluate new oils, what tests to perform and how to evaluate in-service oils.

*Aging characteristics of insulating materials* - Aging is discussed in sections on oil and paper which provides information on how to increase the life of transformers. There are a number of factors that accelerate the aging of the insulation system that can be controlled. This session provides information on when to reclaim or replace oil and gives specifications for reclaimed oil.

*Load tap changer and oil circuit breaker diagnostics* – This presentation gives the latest information on diagnostics for load tap changers (LTCs) and bulk oil breakers. Case studies are provided.

*Sampling* – The presentation discusses how to save money on your sampling program through proper training and what common pitfalls to avoid. Proper sampling preparation, practices, and equipment are given.