

# ELECTRICAL SUBSTATION TRAINING 2018

**RICHMOND, BC**

APRIL 23-24, 2018

**EDMONTON, AB**

APRIL 25-26, 2018

**TORONTO, ON**

APRIL 30 - MAY 1, 2018



#### STUDENTS RECEIVE

- FREE 100-PAGE DIGITAL ELECTRICAL TESTING AND MAINTENANCE HANDBOOK (VALUE \$20)
- \$100 COUPON TOWARD ANY FUTURE ELECTRICITY FORUM EVENT (RESTRICTIONS APPLY)
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2-DAY TRAINING

**\$799**

## DAY ONE

### DAY ONE

#### 1. INTRODUCTION TO SUBSTATIONS

- SUBSTATIONS PRACTICAL EXAMPLES (UPDATED PICTURES TO REFLECT SEVERAL STYLES)
- GENERAL OVERVIEW OF THE SUBSTATION CHARACTERISTICS (TRANSMISSION, DISTRIBUTION, INDUSTRIAL)
- SUBSTATION TYPICAL DOCUMENTATION
- COMMON VOLTAGES THROUGHOUT CANADA AND US HIGH/MEDIUM/LOW CLASS

#### 2. ULTRA HIGH VOLTAGE; HIGH VOLTAGE; MEDIUM VOLTAGE AND LOW VOLTAGE SUBSTATION DEFINITION

- AMERICAN STANDARDS AND DEFINITIONS FOR SUBSTATION
- CANADIAN UTILITY STANDARDS AND VOLTAGE LEVELS FOR UTILITY
- SUBSTATION DESIGN REQUIREMENTS AND INTERNATIONAL STANDARDS

#### 3. FUNCTIONS AND TOPOLOGIES OF SUBSTATIONS

- TRANSFER SUBSTATION
- STEP UP SUBSTATION
- STEP DOWN SUBSTATIONS
- BREAKER AND A HALF; SINGLE BUSS; DOUBLE BUSS; RING BUSS AND OTHER TOPOLOGIES, ADVANTAGE AND DISADVANTAGES
- TYPICAL SUBSTATION SCHEMATICS (SINGLE LINES, CONTROL WIRING, PROTECTIVE DEVICES AND WIRING)
- LAYOUT OF TYPICAL INDUSTRIAL/COMMERCIAL SUBSTATION WITH ONSITE GENERATION

#### 4. POWER CIRCUIT BREAKERS; POWER SWITCHES; POWER FUSES

- INDOOR/OUTDOOR STYLE SUBSTATIONS
- NEW ARC PROOF SWITCHGEAR AND ADVANTAGES
- SWITCHYARDS AND OVERHEAD LINES
- SF6 SWITCHGEAR-GIS (GAS INSULATED SWITCHGEARS)
- SF6 CIRCUIT BREAKERS FOR HIGH AND MEDIUM VOLTAGE, INSULATED AND LIFE TANK
- AIR INSULATED SWITCHGEAR LIMITATIONS
- REPLACEMENT AND MAINTENANCE OF OIL CIRCUIT BREAKERS
- VACUUM CIRCUIT BREAKERS
- VACUUM BREAKERS IN SF6 ENCLOSED SWITCHGEAR
- RESIN-ENCAPSULATED SWITCHGEAR - ADVANTAGE AND LIMITATIONS
- HOW TO SELECT THE BEST SWITCHGEAR FOR THE APPLICATION
- SURGE ARRESTORS POINT OF INSTALLATION

- FEEDERS AND RE-CLOSURES
- USE OF GROUND CARTS AND FEATURES
- LOAD AND NO LOAD POWER SWITCHES
- DIFFERENT TYPES OF FUSING AND CHARACTERISTICS
- MEGGERING; HI-POT AND PI MEASUREMENTS AND INTERPRETATION BASED ON NETA STANDARD

#### 5. POWER TRANSFORMERS EQUIPMENT AND MAINTENANCE

- TRANSFORMER SPILL CONTAINMENT SYSTEMS
- POWER TRANSFORMER CONSTRUCTION
- OIL POWER TRANSFORMERS AND COOLING METHODS
- BUSHING SYSTEM AND BUSHING TAP MONITORING
- BUCHHOLTZ RELAY 63
- OVERPRESSURE PROTECTION SYSTEMS
- GAGES AND MEASUREMENT ON AN OIL-COOLED TRANSFORMER
- RTD DEVICES FOR MONITORING REAL TIME TEMPERATURE
- TAP CHANGING SYSTEM
- DGA-DISSOLVED GAS ANALYSING SYSTEM
- SAMPLING THE OIL AND RESULTS INTERPRETATION
- ONLINE MONITORING SYSTEM (QUALITROL/SEL)
- SFRA OF POWER TRANSFORMERS
- DOBLE TEST EQUIPMENT
- WINDING RESISTANCE TESTING
- RATIO TESTING OF TRANSFORMER

#### 6. SUBSTATION BATTERY SYSTEMS

- SUBSTATION BATTERIES AND CHARGING SYSTEMS
- TYPICAL VOLTAGES AND SETUPS
- EXAMPLES OF DIFFERENT MANUFACTURER AND MONITORING
- EXAMPLES OF ALARMS AND SETTINGS WITHIN CHARGER SOFTWARE
- MAINTANENCE OF BATTERIES

#### 7. SUBSTATION GROUNDING REQUIREMENTS

- SOIL RESISTIVITY MEASUREMENTS
- GROUNDING MODEL AND EVALUATIONS
- SIZING THE GROUNDING SYSTEM
- SAFETY EQUIPMENT GROUNDING IN SUBSTATIONS
- GROUNDING SYSTEM INTERCONNECTIONS
- GROUNDING SYSTEM MAINTENANCE REQUIREMENTS

- POTENTIAL DROP TEST AND INTERPRETATION
- TESTING EQUIPMENT FOR GROUNDING SYSTEMS, GROUND POTENTIAL RISE; STEP AND TOUCH POTENTIAL
- IEEE 80 REQUIREMENTS FOR SUBSTATION GROUNDING

## DAY TWO

### 8. SMART GRIDS

- UNDERSTANDING THE EQUIPMENT AND HOW IT WILL IMPACT THE CHANGING ELECTRICAL GRID
- USE OF AUTO SENSING EQUIPMENT
- IMPACTS TO ELECTRICAL DISTRIBUTION EQUIPMENT
- STRAY CURRENTS
- MAINTENANCE OF GROUND GRIDS AND BONDING OF NON-ELECTRICAL EQUIPMENT

### 9. TYPICAL PROTECTION RELAYS USED IN SUBSTATION

- SELECTING THE PROPER PROTECTION RELAYS
- SELECTING THE CT AND PT
- PERFORMING PROTECTION COORDINATION
- GENERATING PRELIMINARY SETTINGS
- USE OF REMOTE TRIPPING AND CHECKS OF SYSTEM
- SELECTING THE FINAL CIRCUIT BREAKERS AND PROTECTION, USING THE MODEL AND ELECTRICAL CALCULATION SOFTWARE
- GENERATING PROTECTION SETTING SHEETS
- PERFORMING ARC FLASH STUDY AND GENERATING EQUIPMENT LABELS
- NFPA 70E AND IEEE 1584; CSA 462
- TYPICAL PROTECTION FOR SUBSTATIONS TRANSFORMERS AND FEEDERS
- LISTING OF VARIOUS MANUFACTURER OF RELAYING
- TRANSFORMER MONITORING RELAYS AND NEWER MONITORING FEATURES
- EXAMPLE OF A RELAY PROTECTION SETTINGS FOR GE 750, USING ENERVISTA,
- ARC FLASH SENSORS AND USES
- PARTIAL DISCHARGE MONITORING
- CURRENT INJECTION TESTING AND EQUIPMENT

### 10. SUBSTATION POWER FACTOR CORRECTION

- CAPACITOR SYSTEM FOR SUBSTATION POWER FACTOR CORRECTION
- STATIC SYSTEM FOR POWER FACTOR CORRECTION
- CONDENSER SYSTEMS
- MAINTENANCE OF POWER FACTOR CORRECTION SYSTEMS
- DC SUBSYSTEMS

### 11. REMOTE SCADA SYSTEMS AND REMOTE SUBSTATION CONTROL

- NETWORK COMMUNICATIONS FOR POWER SYSTEMS
- SCADA SYSTEM REQUIREMENT
- CELLULAR MODEMS
- RADIO CONTROLLED DEVICES AND REPEATER TOWERS
- INSTALLING SCADA SYSTEMS ON EXISTING SUBSTATIONS
- MONITORING AND CONTROL
- PROCEDURES FOR HANDLING SCADA IN POWER SYSTEMS
- EXAMPLE OF SCADA SYSTEMS
- PRIORITIZATION OF ALARM POINTS IN SCADA

### 12. OTHER REQUIREMENTS TO BE CONSIDERED

- SUBSTATION INSTALLATION
- SAFE OPERATION OF THE SUBSTATION
- SAFE WORK AREA; PPE; IN HAND PROCEDURES
- MAINTENANCE OF THE SUBSTATION GROUNDS/LANDSCAPES
- TESTING AND COMMISSIONING OF A SUBSTATION
- MEGGERING; HIGH POT AND VERY LOW FREQUENCY TEST
- BUS BARS TESTING USING MICRO OHMMETER/INSULATION TESTER
- POWER TRANSFORMER TESTING
- DGA TESTING, ALTERNATIVE METHODS
- TEST RESULTS AND APPROVALS
- NETA STANDARD, AND QUALIFICATIONS OF PERSONNEL

### 13. PAD MOUNTED AND OVER HEAD REMOTE CONTROLLED SWITCHES

- INSTALLATION AND USES TO ASSIST WITH SUBSTATION FEEDS
- COMMISSIONING OF SWITCHES
- EXAMPLES OF VARIOUS MANUFACTURERS

4:00PM - WRAP UP AND Q&A

#### COURSE TIMETABLE:

Start: 8:00 a.m.  
 Coffee Break: 10:00 a.m.  
 Lunch: 12:00 noon (included with course)  
 Restart: 1:15 p.m.  
 Finish: 4:30 p.m.



**1 (855) 824-6131**  
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**ATTENDEE INFORMATION**

To receive registration fee discounts, you must **REGISTER AND PREPAY** prior to the course date.

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**REGISTRATION FEES**

The registration fee to attend the Substation Week Course is **\$799.00** + tax.

The fee includes forum participation, refreshments. NOTE: LUNCH IS PROVIDED WITH THIS COURSE.



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**WHEN & WHERE**

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RONTO AIRPORT  
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Registration fees are refundable only upon receipt of written notification 10 days prior to the conference date, less a 10 per cent service charge. Substitution of participants is permissible.

The Electricity Forum reserves the right to cancel any conference it deems necessary and will, in such event, make a full refund of the registration fees.