

# INTENSIVE COURSE ON PERFORMANCE, RELIABILITY AND DESIGN OF ELECTRICAL AND ELECTRONIC CONNECTORS IN POWER SYSTEMS

17 - 19 February 2025, Hampton Inn & Suites, Clearwater-St Petersburg, 4050 Ulmerton Road, Clearwater, FL. 33762, Tel. 1-727-572-7456

Organized by **TIMRON ADVANCED CONNECTOR TECHNOLOGIES**

## BACKGROUND

Power connections are often the weak links in electrical transmission and distribution systems, and in plants that use large amounts of electrical power. Increased demand for power from renewable resources such as solar and wind is emphasizing reliability of electrical connections not only with external conductors but also within internal systems as in solar panels. Overheating of electrical and electronic connections, are frequent sources of detriment to the overall performance of a power system. Knowledge of the basic principles of power connections, and the causes of contact degradation as presented in this course, will assist in addressing and resolving issues of network/system reliability.

## COURSE DESCRIPTION

This Course provides a practical treatment of the basic principles of electrical contacts and connectors. The Course covers key electrical and mechanical properties of contact materials, effects of friction on separable electrical and electronic power connections, properties of electroplates. The root causes of connector degradation, such as oxidation, fretting, galvanic corrosion, interdiffusion etc., are addressed. Emphasis will be placed on the physical causes for the performance attributes and limitations of several types of power and electronic connections. The technology of bolted, compression, fired-wedge and separable connections, used in conventional, wind- and solar-based systems will be addressed. Techniques for assessing the effective service condition of power connectors in the field will be reviewed. Guidelines for actionable early warning to replace failing electrical connections will be presented.

An important component of the Course focuses on guidelines for connector design, with examples of design approaches for separable connectors and bolted connectors. Class exercises relating to electrical contacts will be carried out.

## WORKSHOP OUTLINE

### ELECTRICAL CONTACT FUNDAMENTALS

1. Surface Roughness and Electrical Contact Resistance
2. Influence of Mechanical Load on Contact Resistance
3. Influence of Surface Oxide Films on Contact Resistance
4. The Temperature in an Electrical Interface
5. Blow-Apart Force in High Current Connections

### CONNECTOR DEGRADATION

1. Corrosion
2. Stress Relaxation / Creep
3. Fretting
4. Thermal Ratcheting
5. Formation of Intermetallics

### BOLTED AND SCREW CONNECTIONS

1. Special Features of Bolted Connections
2. Effects of Metal Creep and Stress Relaxation on Contact Force
3. Design Guidelines for Bolted/Screw Connections

### CRIMP/COMPRESSION CONNECTIONS

1. How Crimp/Compression Connections Work
2. Results of Testing of Electronic Crimp and Power Compression Connectors

### MITIGATING MEASURES FOR CONNECTORS

1. Surface Preparation
2. Mechanical Contact-Aids, Lubricants

### 3. Coatings / Platings

### THE ELECTRIC ARC

1. Properties of Electric Arcs
2. Arc Formation in an Electrical Connection

### ELECTRICAL CONNECTIONS IN SOLAR MODULES

1. How a solar module works
2. Connector Failure in Solar Modules
3. Arcing in Solar Modules
4. Grounding Connections

### ELECTRICAL CONTACT MATERIALS

1. Metallurgical Properties of Contact Materials
2. Effects of Heat Treatment and Aging of Metal Alloys

### CONNECTOR DESIGN GUIDELINES

1. Major Connector Technologies (separable connectors, Pogo pins, Insulation Displacement Connectors, press fit, crimp connectors, screw connectors, solder joints, ultrasonic welding)
2. Examples of Design of Separable Connectors

### DETECTION OF CONNECTOR DEGRADATION IN THE FIELD

1. Resistance Measurements
2. Infrared Measurements

## WHO SHOULD ATTEND

The Course is intended for all levels of engineering personnel involved with the design, testing, installation, maintenance, operation, and failure analysis of electrical connections.

## GENERAL INFORMATION

### SCHEDULE

Days 1 - 3: 8:00 am - 5:00 pm  
Breaks: 10:15 am / 12:15 pm / 3:00 pm

### REGISTRATION AND WORKSHOP CANCELLATION

Advance registration, indicated on the Registration Form will be required. Total enrolment will be limited. Organizers reserve the right to cancel the Course (with a full refund of fees) if advance registration is inadequate.

### REGISTRATION CANCELLATION AND DELEGATE SUBSTITUTION

Full refund of registration fee, less US\$ 200.00, will be made for cancellations received in writing before 31 January 2025. Fees will not be refunded for cancellations on or after this date. Delegate substitution is permitted up to and including the day of the Course.

### ACCOMMODATIONS

Reservations can be made by contacting the hotel at 727-572-7456 to request the preferred "Timron" Course room rate of \$ 209.00, valid until 01/24/25. The hotel is located about 1 mile from the St Pete-Clearwater International Airport, and offers free parking.

### INSTRUCTOR

*Dr. R.S. Timsit* spent 20 years in R&D in the aluminum industry where he focused on connector conductor alloys and connector design, brazing and metalworking. He later joined AMP Inc. (now TE Connectivity) and led technology development for the AMP Power Technology Division as Chief Technologist. Dr. Timsit is recipient of the IEEE

Ragnar Holm Scientific Award for innovative research in electrical contacts. He is also recipient of four international awards relating to electrical contacts and metal joining. He has authored over 132 papers and holds 18 patents. He is instructor at the IEEE Intensive Course on Electrical Contacts. In 1999, Dr. Timsit established Timron Scientific Consulting Inc.(TSC), Toronto, Canada, a company focusing on the design and failure analysis of electronic and electrical power connectors and switches, in the Americas, Europe and Asia.

## REGISTRATION FORM

### PERFORMANCE, RELIABILITY AND DESIGN OF ELECTRICAL POWER CONNECTIONS

Name: \_\_\_\_\_  
Company: \_\_\_\_\_  
Title: \_\_\_\_\_  
Address: \_\_\_\_\_  
City: \_\_\_\_\_  
State/Province: \_\_\_\_\_  
Zip/Postal Code: \_\_\_\_\_  
Phone: \_\_\_\_\_ FAX: \_\_\_\_\_  
Email: \_\_\_\_\_

## REGISTRATION FEE

Before January 31, 2025 US\$ 1,950.00  
On or After January 31, 2024 US\$ 2,075.00

Enclosed is a payment for US\$ \_\_\_\_\_

**A discount of 10% is offered for each of two or more attendees from the same company.**

### PAYMENT MUST ACCOMPANY REGISTRATION FORM

Please make your check payable to:

**Timron Scientific Consulting Inc.,**

**VISA, MasterCard and American Express credit cards are accepted; An overcharge of 1.8% will be added to payments by American Express.**

Charge my \_\_\_\_\_ Card (please specify)

Card #: \_\_\_\_\_  
Exp. \_\_\_\_\_

Name on Card: \_\_\_\_\_

Signature: \_\_\_\_\_

We recommend payment by check, or invoicing if you provide a purchase order number, to preclude possible credit card account charges by your bank.

Mail, Fax or Email to:

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