Training Course on Circuit Breaker Timing Tests and Velocity Type

Professional Development Training Course Outline

Category	Development	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

In the evolving landscape of electrical power systems, circuit breaker timing tests and velocity type diagnostics have become essential components of preventive maintenance and reliability assessment. Training Course on Circuit Breaker Timing Tests and Velocity Type is designed to equip engineers, technicians, and maintenance professionals with in-depth technical knowledge and hands-on skills necessary to evaluate circuit breaker performance through advanced diagnostic methods. Understanding how timing and motion parameters affect breaker operation can prevent costly failures and improve system safety.

As the global energy infrastructure grows more complex, the ability to interpret breaker timing data, analyze velocity curves, and detect anomalies before failure becomes a competitive edge for electrical professionals. This course integrates real-world case studies, trending tools, and data-driven approaches to prepare participants for field and lab environments. With increasing focus on smart grid integration, predictive analytics, and IEC/IEEE standards compliance, this training positions attendees as key players in power system reliability and asset management.

Programme Curriculum

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Course Objectives

1. Understand the fundamentals of circuit breaker operation and its role in power system protection.
2. Learn the purpose and procedures for circuit breaker timing tests using modern testing equipment.
3. Interpret velocity characteristics and their significance in motion analysis.
4. Differentiate between timing faults, mechanical faults, and electrical faults in breakers.
5. Utilize diagnostic software to generate motion profiles and analyze trends.
6. Apply predictive maintenance techniques using timing and velocity data.
7. Recognize the influence of environmental factors and breaker type on performance metrics.
8. Master contact travel measurement and analyze its correlation with operational timing.
9. Evaluate minimum trip time, closing time, and arcing contact behavior.
10. Compare hydraulic, spring, and pneumatic mechanisms using velocity profiles.
11. Implement best practices for substation breaker testing with safety protocols.
12. Review international standards (IEEE, IEC, ANSI) for timing and velocity diagnostics.
13. Conduct post-test assessments and compile data-driven maintenance reports.

Target Audience

1. Electrical Maintenance Engineers
2. Power System Protection Engineers
3. Substation Technicians
4. Electrical Supervisors and Managers
5. Commissioning Engineers
6. Industrial Maintenance Teams
7. Utility Engineers
8. Power System Consultants

Course Duration: 10 days

Course Modules

Module 1: Introduction to Circuit Breakers

- Types and applications of circuit breakers
- Role in system protection
- Overview of breaker mechanisms
- Importance of timing and motion analysis
- Key test parameters
- **Case Study:** Failure analysis of a 132kV breaker due to delayed trip signal

Module 2: Timing Test Fundamentals

- Definition of open/close/trip time
- IEEE and IEC timing standards
- Test circuit configurations
- Analog vs digital test sets
- Interpreting timing curves
- **Case Study:** Diagnosing sluggish closing time in oil circuit breakers

Module 3: Velocity and Motion Analysis

- Measuring contact velocity
- Travel-time vs. velocity correlation
- Motion sensors and tools
- Velocity signatures by breaker type
- Detecting mechanical issues via motion
- **Case Study:** Abnormal velocity trace in spring-operated vacuum breaker

Module 4: Test Equipment and Setup

- Overview of major test kits (Megger, OMICRON, SMC)
- Connection techniques and configuration
- Safety during setup and disconnection
- Calibration and accuracy checks
- Real-time monitoring integration
- **Case Study:** Field test comparison using Megger EGIL vs OMICRON CIBANO 500

Module 5: Interpreting Test Results

- Reading breaker timing graphs
- Thresholds and tolerance levels
- Open-close-open (OCO) cycle analysis
- Contact resistance implications
- Cross-phase analysis
- **Case Study:** Time delay diagnosis in SF6 breaker due to actuator lag

Module 6: Contact Travel and Distance Measurement

- Contact travel vs. contact velocity
- Movement graphs and data points
- Importance of bounce detection
- Identifying worn-out mechanisms
- Software visualization techniques
- **Case Study:** Detection of arcing contact wear in live tank breaker

Module 7: Mechanical Fault Detection

- Common mechanical failure points
- Correlation of timing/velocity to mechanical faults
- Effects of spring fatigue
- Vibration indicators in motion
- Timing test as mechanical health indicator
- **Case Study:** Identifying binding issues in a bulk oil breaker

Module 8: Electrical Fault Detection

- Coil resistance testing
- Control voltage drop effects
- Coil timing irregularities
- Link to relay coordination
- DC vs AC control circuit implications
- **Case Study:** Open trip coil detection in 230kV circuit breaker

Module 9: Substation Testing Protocols

- Pre-test checklist

- Energized vs de-energized breaker testing
- Live line testing safety
- Equipment grounding practices
- Documentation of test records
- **Case Study:** Successful diagnostic testing during live substation inspection

Module 10: Predictive Maintenance Approaches

- Condition-based monitoring strategies
- Digital twin modeling
- Anomaly detection algorithms
- Integration with SCADA/EMS
- Trend tracking and action thresholds
- **Case Study:** Scheduled replacement based on timing degradation trend

Module 11: Breaker Mechanism Types and Behavior

- Spring, hydraulic, pneumatic differences
- Timing pattern distinctions
- Mechanism age impact
- Hybrid operating systems
- Predicting end-of-life behavior
- **Case Study:** Malfunction in hydraulic-operated SF6 breaker at 400kV level

Module 12: International Testing Standards

- Comparison: IEC 62271 vs IEEE C37
- Tolerance interpretation
- Global compliance needs
- Standard test reporting formats
- Test frequency guidelines
- **Case Study:** Resolving standard violation in African grid network

Module 13: Data Analysis & Report Generation

- Key metrics to include in reports
- Visualizing timing/motion data
- Fault categorization
- Maintenance prioritization
- Archival and audit requirements
- **Case Study:** Intelligent report insights saved $1M in outage costs

Module 14: Case-Based Troubleshooting Techniques

- Structured troubleshooting flowcharts
- Linking tests to operational behavior
- Historic data comparison
- Root-cause analysis techniques
- Mitigation strategy formulation
- **Case Study:** Forensic analysis of breaker trip failure during fault event

Module 15: Final Assessment and Workshop

- Practical demo of timing test
- Hands-on with velocity sensors
- Real test data interpretation

- Report preparation walkthrough
- Group discussion and feedback
- **Case Study:** Full-scope test audit on multi-vendor breaker fleet

Training Methodology

- Interactive instructor-led presentations
- Live demonstrations of breaker testing
- Hands-on training with test equipment
- Problem-solving with real case studies
- Collaborative group activities and Q&A

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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