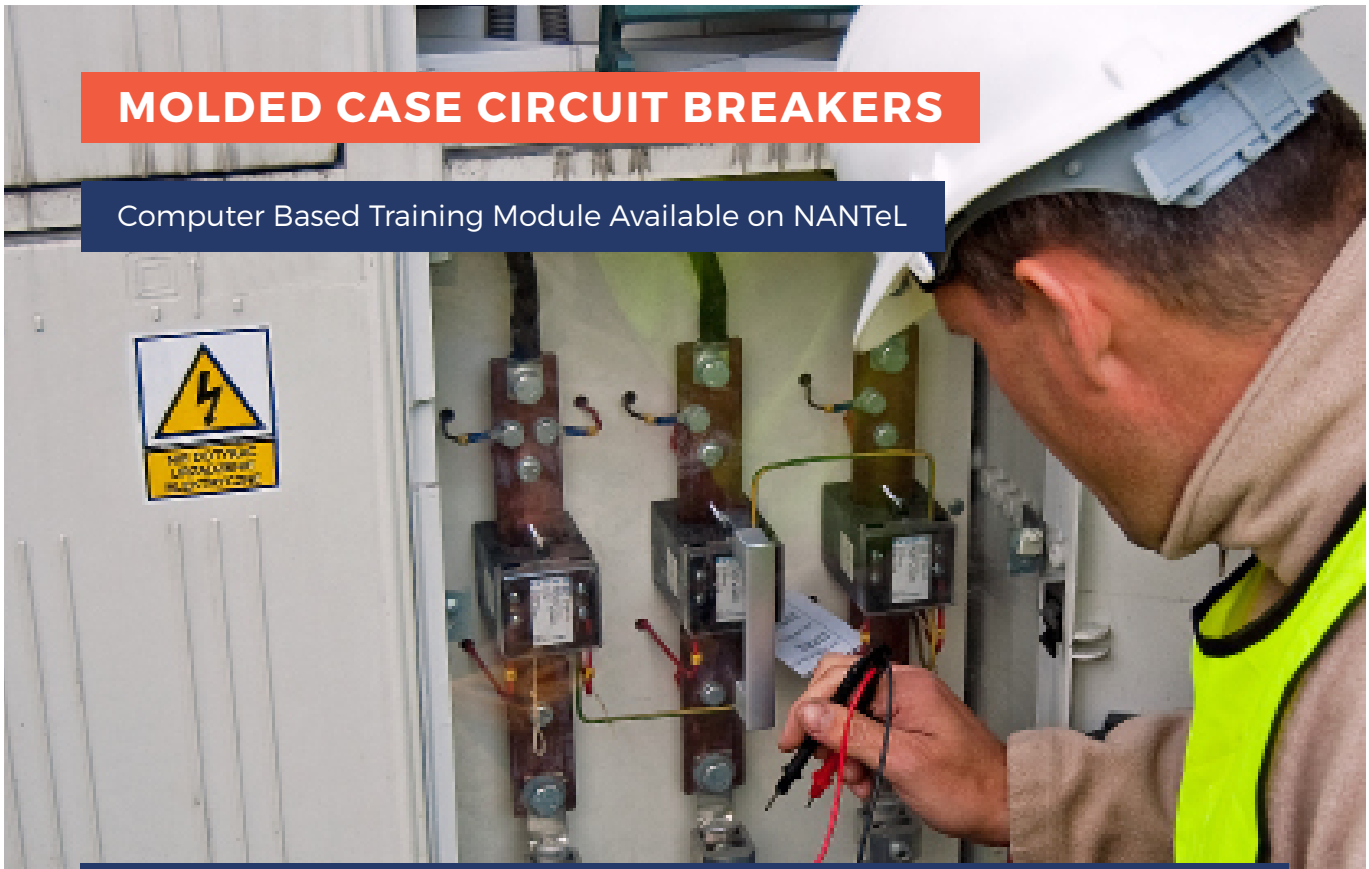
MOLDED CASE CIRCUIT BREAKERS

Computer Based Training Module Available on NANTeL



ABSTRACT

The AET course for Molded Case Circuit Breakers and Thermal Overload Relays provides the engineer with an understanding of the design, types and purpose of these components in the nuclear environment. It addresses the specifics of design types, their operation, maintenance and testing of the components and regulatory requirements and considerations. The engineer for Molded Case Circuit Breakers and Thermal Overload relays will have a generic design and licensing basis for performing engineering evaluations and responses to industry and regulatory issues.

INTENDED AUDIENCE

1. Experienced nuclear plant mechanical engineers who are developing expertise in Molded Case Circuit Breakers

DURATION

- 2.5 hours
- An additional 8-12 hours for reading materials provided within the CBT

TERMINAL LEARNING OBJECTIVES

1. Describe the configuration, construction and theory of operation of MCCBs typically used in Motor Control Centers (MCCs) at commercial nuclear generating stations as explained in industry guidelines and as described in Westinghouse Technical Bulletin 06-2, (which included excerpts “A Working Manual on Molded Case Circuit Breakers”).
2. Describe the configuration, construction, and theory of operation of TORs typically used in Motor Con-trol Centers (MCCs) at commercial nuclear generating stations and as explained in NEMA ICS 2; Part 4, Section 4.
3. Explain and apply the terms common to engineer activities involving MCCBs and TORs, as defined in industry guides and standards.
4. Describe the purpose and interconnections of the Molded Case Circuit Breakers (MCCBs) and Thermal Overload Relays (TORs) as typically applied in a Motor Control Centers (MCCs) and as explained in in-dustry guidelines, e.g., EPRI TR-1009832.
5. Explain how performance requirements for MCCBs and TORs are determined from breaker coordina-tion analysis applicable to MCCs at commercial nuclear generating stations and as detailed in EPRI TR-1009832.
6. Explain how manufacturer’s Time-Current Curves (TCC) for MCCBs and TORs are used in engineering analyses and when determining test acceptance criteria, per guidance in EPRI TR-1009832.
7. Describe the impact that varying service conditions can have on the performance of MCCBs and TORs with respect to the published manufacturer’s Time Current Characteristics (TCC), and as explained in EPRI TR-1009832.
8. Identify parameters found on suppliers’ and manufacturers’ datasheets for MCCBs and TORs that must be included in procurement specifications for applications in MCCs used at nuclear power plant.
9. Describe typical design margin in breaker sizing, selection, and coordination with other protective devices as it relates to MCCBs and TORs, including impact to operating requirements and performance, which are sensitive to temperature variation and electrical transients, to the extent included in industry guidelines (e.g., EPRI TR-1009832).
10. Identify the seismic, environmental, and electro-magnetic compatibility (EMC; EMI/RFI) qualification criteria that must be included in a procurement specification for MCCBs and TORs pursuant to industry standards (e.g., 10 CFR 50, Regulatory Guides, IEEE Standards).
11. Describe the relevant considerations of nuclear plant design and licensing bases (pursuant to 10 CFR 50 and Regulatory Guides) when making any change in model, style, form, fit or function during replacement or upgrade of MCCBs and TORs, and the additional considerations and constraints required when specifying digital or electronic MCCBs.
12. Describe the typical postulated failure modes and mechanisms of MCCBs and TORs, and how Failure Modes and Effects Analysis (FMEA) is applied by engineering to preventive maintenance or when troubleshooting, as addressed in industry guidelines (e.g., those published by EPRI).

13. Describe maintenance and testing of MCCBs and TORs enhancements that have resulted from nuclear industry operating experience, e.g. NRC IN 96-24, INPO Operating Reports, manufacturer's technical bulletins.
14. Describe the types of testing methods for MCCBs and TORs, and their application to trouble shooting or maintenance as can be found in published industry guidance, e.g., NRC IN 92-51, NEMA AB-4, EPRI TR-1009832, and UL 489.
15. Evaluate service life using under plant environment and service conditions when determining preventative maintenance for MCCBs and TORs based on suppliers' and manufacturers' data (or documenta-tion) and industry guidelines (e.g., IEEE 1458-2005, EPRI TR-1009832).

KEY INDUSTRY DOCUMENTS

1. Eaton - 3P Series Molded Case Circuit Breakers Overview (Vendor Manual)
2. Eaton-Reverse Feed Breakers Summary (Letter)
3. EPRI MCCB TR-1009832 "Molded Case Circuit Breaker Application and Maintenance Guide"
4. NRC Bulletin 74-008 (Deficiency in ITE Molded Case Circuit Breaker, Type HE-3)
5. NRC Bulletin 88-10 (Nonconforming Molded Case Circuit Breakers)
6. NRC Information Notice 85-16 (Time/Current Trip Curve Discrepancy of ITE/Siemens-Allis Molded Case Circuit Breaker)
7. NRC Information Notice 86-62 (Potential Problems in Westinghouse Molded Case Circuit Breakers Equipped with a Shunt Trip)
8. NRC Information Notice 88-45 (Problems in Protective Relay and Circuit Breaker Coordination)
9. NRC Information Notice 88-46 (Licensee Report of Defective Refurbished Circuit Breakers)
10. NRC Information Notice 88-46 Supplement 1 (Licensee Report of Defective Refurbished Circuit Breakers)
11. NRC Information Notice 89-21 (Changes in Performance Characteristics of Molded-Case Circuit Breakers)
12. NRC Information Notice 90-43 Supplement 1 (Mechanical Interference with Thermal Trip Function in GE Molded Case Circuit Breakers)
13. NRC Information Notice 91-29 (Deficiencies Identified During Electrical Distribution)
14. NRC Information Notice 91-48 (False Certificates of Conformance provided by Westinghouse Electric Supply Company for Refurbished Commercial-Grade Circuit Breakers)
15. NRC Information Notice 92-03 (Remote Trip Function Failures in General Electric F-Frame Molded-Case Circuit Breakers)
16. NRC Information Notice 92-51 (Misapplication an Inadequate Testing of Molded-Case Circuit Breakers)
17. NRC Information Notice 92-51 Supplement 1 (Misapplication an Inadequate Testing of Molded-Case Circuit Breakers)
18. NRC Information Notice 93-22 (Tripping of Klockner-Moeller Molded-Case Circuit Breakers due to Support Lever Failure)
19. NRC Information Notice 93-26 (Grease Solidification Causes Molded-Case Circuit Breaker Failure to Close)
20. NRC Information Notice 93-26 Supplement 1 (Grease Solidification Causes Molded-Case Circuit Breaker Failure to Close)
21. NRC Information Notice 93-64 (Periodic Testing and Preventive Maintenance of Molded Case Circuit Breakers)
22. NRC Information Notice 96-24 (Preconditioning of Molded-Case Circuit Breakers Before Surveillance Testing)
23. Schneider Electric Data Bulletin 0600DB0102 (p1-2)