Specification Guide

for

RMAX™

Direct Replacement

AC Low Voltage

Power Circuit Breakers

ABB Inc.
Circuit Breaker Technology Solutions
2300 Mechanicsville Rd.
Florence, SC 29501

Ph. (843) 413-4700
Toll Free (877) SOS-CBTS
Fax. (843) 413-4850

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1.0 General Work Scope

This specification covers the design, testing, manufacturing requirements, on-site installation and installation conformance of low voltage replacement circuit breakers. The LV replacement circuit breakers shall be functional replacements (both mechanically and electrically) for the existing power circuit breakers listed in this specification. The replacement breakers shall be directly interchangeable between the breaker cells of the same ampere class and interrupting of the original equipment without cell modifications. The replacement circuit breaker shall be an ABB RMAX low voltage replacement breaker or approved equal.

2.0 Standards

The replacement circuit breakers shall be designed, fabricated and tested in accordance with the latest applicable standards of the American National Institute (ANSI), National Electrical Manufacturers Association (NEMA), and the Institute of Electrical and Electronics Engineers, Inc. (IEEE).

2.1 ANSI C37.13 “Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures”
2.2 ANSI C37.16 “LV Power Circuit Breakers Preferred Ratings”
2.3 ANSI C37.17 “Trip Devices for AC and DC Low Voltage Power Circuit breakers”
2.4 ANSI C37.20.1 “Standard for Metal Enclosed Low Voltage Switchgear”
2.5 ANSI C37.50 “Low Voltage AC Power Circuit Breakers used in Enclosures and Test Procedures”
2.6 CSA 22.2
2.7 UL1066 “Low Voltage AC and DC Power Circuit Breakers used in Enclosures”
2.8 ANSI C37.59 “IEEE Standards for Conversions of Power Switchgear Equipment”

3.0 Supplier Qualifications

3.1 The supplier shall have replacement circuit breakers in service for a minimum of five (5) years.
3.2 The supplier shall be able to demonstrate experience in replacement breaker design for a minimum of five (5) years.
3.3 The supplier shall be the original manufacturer of the circuit breaker element being applied to the replacement circuit breaker.

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4.0 Mechanical and Electrical Ratings

4.1 Mechanical

4.1.1 The rated mechanical life of the circuit breaker element shall be not less than 15,000 operations for frames of 1200A and below.

4.1.2 The rated mechanical life of the circuit breaker element shall be not less than 10,000 operations for continuous current frames of 2500A.

4.1.3 The rated mechanical life of the circuit breaker element shall be not less than 5,000 operations for frames of 3200A through 5000A.

4.1.4 The power circuit breaker element shall have an operating temperature of -5°C to +70°C and a relative humidity of 90%.

4.2 Electrical

4.2.1 The rated electrical life of the circuit breaker element shall be not less than 10,000 operations for frames of 1600A and below.

4.2.2 The rated electrical life of the circuit breaker element shall be not less than 8,000 operations for frames of 2500A.

4.2.3 The rated electrical life of the circuit breaker element shall be not less than 5,000 operations for frames of 3200A and 4000A.

4.2.4 The rated electrical life of the circuit breaker element shall be not less than 3,000 operations for 5000A continuous current frames.

4.2.5 The power circuit breaker element shall have a rated voltage of up to 600Vac (60 Hz.)

4.2.6 The rated insulation voltage of the power circuit breaker element shall be equal to or greater than 1000 Vac.

4.2.7 The power circuit breaker element shall have a low frequency withstand rating of 2.2kV.

4.2.8 The rated impulse withstand voltage of the power circuit breaker element shall be 12kV as a minimum.

4.2.9 The power circuit breaker element shall be rated for 100% of its continuous rating (100% rated).

5.0 Circuit Breaker Element Construction

5.1 The power circuit breaker element shall be assembled in an ISO 9001-2000 certified facility.

5.2 The element shall employ dual insulation to provide total segregation between the power circuit and the control circuit.

5.3 The power circuit breaker element shall be of the same manufacturer and cover a rated continuous current range of 800A to 5000A.

5.4 The main contacts shall be separated from the arc-breaking contacts.

5.5 The power circuit breaker shall be metal encased. Circuit breaker elements advertised as insulated case shall not be permitted.

5.6 The main contacts shall be silver faced; arcing contacts shall have non-welding and high conductivity features.

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5.7 Each low voltage power circuit breaker element shall be equipped with current sensors and a self-trip device to sense overload, short circuit, and ground fault conditions. The self-trip device shall be interchangeable so that any trip device can be used with any frame size circuit breaker.

5.8 Each circuit breaker element shall be provided with manual open and close pushbutton controls, spring charged/discharged indicator, and primary contact status open or closed indicators.

5.9 The circuit breaker element shall be provided with a self-contained manual charging lever for manually charging of the charging spring.

5.10 The operating mechanism of the power circuit breaker element shall use closing springs that are loaded by motor for electrically operated breakers or via a manual charging lever for manually operated breakers.

5.11 All close and open coils shall be of universal design and be selected based on the control voltage indicated. The coil design shall be such that it can be universally used regardless of frame size. They shall be rated for continuous duty and interchangeable between open or close positions.

5.12 All breaker element accessories including open coils, trip coils and the spring charging motor shall be UL listed. These accessories shall be easily plugged in/installable in the front of the circuit breaker element without the use of wire terminals. These accessories shall be universally adaptable across the available breaker frame size.

5.13 The auxiliary contacts on the circuit breaker element must be field reconfigurable such that they can be changed from normally open to normally closed or visa versa.

6.0 Trip Unit

6.1 The over current trip unit on the power circuit breaker element shall be true RMS sensing and provided with all trip features including long time, short time, instantaneous and ground fault. The trip device shall be easily programmable by direct keypad programming on the breaker or by a hand held multi-function test/programming device. One hand held multi-function test/programmer shall be provided and shall be suitable for use regardless of the breaker frame size. The hand held multi-function testing/programmer shall be portable, weigh less than 10 pounds and be rechargeable. Such devices requiring continual AC power shall not be permitted.

6.2 The trip device shall have a direct reading backlit LCD display of load current on phases, neutral and ground. It shall indicate percent primary contact wear, cause of trip and provide the number of breaker operations. The trip unit shall be universal for application across the frame size ratings without the use of rating plugs. The trip unit shall be UL listed and easily field-changeable by maintenance personnel.

6.3 All power circuit breaker elements included in this specification shall be equipped with the same 16 bit microprocessor-based over current protection trip unit. The trip unit shall be able to operate without an auxiliary power supply and shall be sensitive to the true RMS value of the fault current.

6.4 The trip unit shall have self-diagnostics and provide indication when the trip unit microprocessor is failed or is operating out of the tolerance band.

6.5 The trip unit shall have a pre-alarm warning LED that displays the type of pre-alarm. Pre-alarms to be included are phase unbalance; overloads greater than 80% of trip setting, and contact wear in excess of 80%.

6.6 The trip unit shall be provided with indication of cause of trip via LED's or magnetic flags. Trip units requiring battery backup for this function are not acceptable.

6.7 The trip unit shall have provisions for communicating via RS 485 serial transmission using ModBus protocols.

6.8 Information and signals available through communications links shall include: protection parameters, unit configuration, breaker and unit status, pre-alarms, alarms, metered values, event log, contact wear and number of operations.

7.0 Roll-in Replacement Circuit Breaker Construction

7.1 The roll-in replacement circuit breaker shall have a complete ANSI-tested, motor-charged two-step, stored energy spring mechanism. The element shall be mounted in a steel frame structure which interfaces with the existing cell levering system and has primary connections which match the existing inter and intra-phase spacing.

7.2 The replacement circuit breaker frame shall be constructed from steel. A combination of bolting and welding to assemble the frame is acceptable. The frame and associated interlocks shall be provided with a painted or zinc-plated with a yellow dichromate, protective coating to prevent the corrosive effects of the atmosphere. All hardware shall be a minimum grade five (5), zinc-plated or black oxide to prevent the corrosive effects of the atmosphere.

7.3 The replacement breaker shall be held mechanically and electrically trip free during breaker levering. Safety interlocks shall interface with the existing breaker cell to prevent the breaker levering into the primary contacts in the closed position.

7.4 Control wiring shall be #14 gauge, type SIS as a minimum. Wiring internal to the circuit breaker element and related trip unit are exempt from this requirement.

7.5 The primary connections and/or finger clusters shall be new, designed and tested to carry the full nameplate rating of the replacement circuit breaker without exceeding the allowable temperature rise as indicated by ANSI.

7.6 The primary contacts shall be capable of withstanding the full rated short circuit current rating of the circuit breaker as defined by ANSI for open-close-open tests.

7.7 The new secondary contact block for electrically operated circuit breakers shall be new and shall be capable of interfacing with the existing contact block located in the existing cubicle. Cell modifications of the enclosure are unacceptable.

7.8 A new door shall be furnished and installed with each new replacement circuit breaker. The door hinge gage and thickness shall match that of the existing door. The door shall be painted ANSI 61, light gray.

7.9 The replacement breaker shall be designed to permit racking (connected or disconnected) with the cell door closed.

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7.10 The replacement breaker shall have provisions to operate with the existing cell interlocks to discharge the tripping and closing springs before or during circuit breaker insertion or withdrawal from the breaker cell.

7.11 Spring charge/discharge and breaker position indicator shall be visible on the front of the breaker.

7.12 The racking mechanism shall correctly interface with the existing switchgear design racking interfaces and cell parts. Cell and control wiring changes needed to accommodate the replacement circuit breaker are not acceptable.

7.13 The replacement breakers shall be directly interchangeable between the breaker cells of the same ampere class and interrupting rating of the original equipment without cell modifications.

7.14 The replacement circuit breaker shall be of new construction. Reused or reconditioned components will not be acceptable. Converting the existing breaker carriage or racking mechanism for use with the replacement breaker will not be permitted.

7.15 The replacement circuit breaker shall be designed such that a positive ground connection is maintained in the connected position and throughout the racking process.

8.0 Installation Conformance

8.1 The replacement breaker manufacturer shall verify functional operation of all circuit breaker interlocks, cell interfaces and levering assembly in a cell structure in the replicated cell at the factory and again verify the same at each cell location for which the replacement breaker is installed. The service of factory trained service technicians shall be included to accomplish and verify this conformance.

8.2 The supplier shall also set all trip unit settings on each replacement circuit breaker as required for each circuit breaker being replaced under this project. The owner shall furnish the supplier with a recent coordination study for this purpose.

9.0 Documentation and Drawing Requirements

9.1 The circuit breaker element shall be supplied with certificates of type tests on similar devices performed by the manufacturer.

9.2 Copies of the design tests of the replacement breaker shall be supplied.

9.3 Copies of the production tests of the replacement breaker shall be supplied.

9.4 Outline drawings of the replacement circuit breaker shall be supplied.

9.5 Schematic wiring diagram of the circuit breaker element and connection diagram shall be supplied.

9.6 Schematic and wiring diagram of the replacement circuit breaker shall be supplied.

9.7 Instruction books for the replacement circuit breaker shall be provided. The instruction book shall also include the circuit breaker element.

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