

PEARL Reconditioning Standards			
LOW VOLTAGE MOLDED CASE CIRCUIT BREAKERS WITH SOLID STATE TRIP UNIT	Revision		
	Standard	Number	Date
	1212	5	11-2008

The term "reconditioning" is defined as "the process of returning electrical equipment to safe and reliable operating condition based upon the design of the original manufacturer at the time of manufacturing."

NOTE: This standard pertains only to those breakers that can be opened for inspection, maintenance and part(s) replacement purposes. This standard does not pertain to riveted frame molded case circuit breakers and other such breakers.

NOTE: If fuses are installed, they are to be properly designed and rated with respect to voltage and interrupting rating for the device and specific application for which they are intended, and must be approved by the customer for said purpose. The final determination is ultimately the responsibility of the end user

REFERENCES

The following references are use in this standard. Each of these references can be found in their respective listed locations.

Table References: Section 6000

- Table 1 US Standard bus connection bolt torque values.
- Table 2 Insulation resistance and test values for electrical apparatus.
- Table 11 Insulation resistance and test temperature conversion to 20°C values.

National Electrical Code – NEC 2002 Edition

- Article 310 Conductors for General Wiring
- Table 310.17 Allowable Ampacities of Single-Insulated Conductors Rates 0 Through 2000 Volts in Free Air, Based on Ambient Air Temperatures of 30°C (86°F).

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I TEST EQUIPMENT

The following test equipment is required to perform the testing requirements of this reconditioning standard:

1. Insulation Resistance Test Set (Megohmmeter) 1000 Vdc minimum
2. High Current Test Set

One of the following pieces of test equipment is required to perform the contact resistance testing requirements of this reconditioning standard:

1. Digital Low Resistance Ohmmeter (DLRO - 10 amp unit is sufficient.)
3. DC Current Source and a Millivoltmeter

One of the following pieces of test equipment may be required to perform the testing requirements of this reconditioning standard, depending on the accessories:

1. AC Voltage Supply
2. DC Voltage Supply

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II RECONDITION EVALUATION

These steps are used to determine what will be required to recondition this product under this standard.

1 INSPECTION

1.1 Case

- 1.1.1** Ensure that the nameplate/label data is legible.
- 1.1.2** Ensure that the third party listing service label is legible.
- 1.1.3** Inspect case for cracks, chips and unused holes.
- 1.1.4** Inspect case for signs of overheating.
- 1.1.5** Inspect all control wire for signs of deterioration, overheating and damage.
- 1.1.6** Inspect for missing parts.
- 1.1.7** Record results on an approved PEARL Evaluation Form.

1.2 Lugs

- 1.2.1** Inspect for tightness.
- 1.2.2** Inspect for signs of overheating.
- 1.2.3** Inspect plating.
- 1.2.4** Inspect for signs of cross threads and stripped threads.
- 1.2.5** Record results on an approved PEARL Evaluation Form.

1.3 Operating Mechanism

- 1.3.1** Inspect for signs of rust and corrosion.
- 1.3.2** Inspect for excessive and inappropriate lubrication.
- 1.3.3** Inspect for missing screws, bolts, nuts, fasteners, retainers and keepers.
- 1.3.4** Manually operate circuit breaker a minimum of three (3) times while checking for proper operation of the quick-make and quick-break feature.
- 1.3.5** Record results on an approved PEARL Evaluation Form.

1.4 Interphase Separators

- 1.4.1** Inspect for dust, dirt and foreign materials.
- 1.4.2** Inspect for chips, cracks and deterioration.
- 1.4.3** Inspect for overheating.
- 1.4.4** Record results on an approved PEARL Evaluation Form.

1.5 Arc Extinguishers/Chutes

- 1.5.1** Inspect for loose and missing parts.
- 1.5.2** Inspect for dust, dirt, foreign material, cracks, chips and signs of overheating.
- 1.5.3** Inspect for excessive deterioration and carbon buildup on the metal separator.
- 1.5.4** Inspect arc runners for excessive deterioration.
- 1.5.5** Record results on an approved PEARL Evaluation Form.

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- 1.6 Arcing Contacts**
 - 1.6.1 Inspect for excessive deterioration.
 - 1.6.2 Inspect for cracks, chips and pitting.
 - 1.6.3 Check for proper alignment/seating in the closed position.
 - 1.6.4 Record results on an approved PEARL Evaluation Form.
- 1.7 Main Contacts**
 - 1.7.1 Inspect for excessive deterioration.
 - 1.7.2 Inspect for cracks, chips and pitting.
 - 1.7.3 Check for proper alignment/seating in the closed position.
 - 1.7.4 Record results on an approved PEARL Evaluation Form.
- 1.8 Current Carrying Components**
 - 1.8.1 Inspect hinge/pivot joints for signs of overheating.
 - 1.8.2 Inspect hinge/pivot joints for missing and defective parts.
 - 1.8.3 Inspect any other current carrying components for signs of overheating.
 - 1.8.4 Inspect any other current carrying components for missing and defective parts.
 - 1.8.5 Record results on an approved PEARL Evaluation Form.
- 1.9 Overcurrent Trip System**
 - 1.9.1 General**
 - 1.9.1.1 Inspect for signs of overheating.
 - 1.9.1.2 Inspect for corrosion and rust.
 - 1.9.1.3 Inspect for missing and defective screws, bolts, nuts, fasteners and keepers.
 - 1.9.1.4 Check for loose and defective terminal connectors.
 - 1.9.1.5 Record results on an approved PEARL Evaluation Form.
 - 1.9.2 Wiring Harness**
 - 1.9.2.1 Inspect for overheating.
 - 1.9.2.2 Inspect for pinched, damaged and deteriorated insulation.
 - 1.9.2.3 Record results on an approved PEARL Evaluation Form.
 - 1.9.3 Flux Shifter**
 - 1.9.3.1 Inspect for overheating.
 - 1.9.3.2 Inspect for binding.
 - 1.9.3.3 Inspect for loose connections.
 - 1.9.4 Current Sensors/Transformers**
 - 1.9.4.1 Inspect for overheating.
 - 1.9.4.2 Inspect for cracked and damaged outer casing.
 - 1.9.4.3 Inspect for loose connections.
 - 1.9.4.4 Record results on an approved PEARL Evaluation Form.
- 1.10 Shunt Trip Devices**
 - 1.10.1 Inspect shunt trip unit for missing and defective screws, bolts, nuts, fasteners and keepers.
 - 1.10.2 Inspect shunt trip unit for signs of overheating and deteriorated insulation.
 - 1.10.3 Check shunt trip unit for loose and defective terminal connectors.

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1.10.4 Record results on an approved PEARL Evaluation Form.

1.11 Undervoltage Trip Devices

1.11.1 Inspect undervoltage trip unit for missing and defective screws, bolts, nuts, fasteners and keepers.

1.11.2 Inspect undervoltage trip unit for signs of overheating and deteriorated insulation.

1.11.3 Check undervoltage trip unit for loose and defective terminal connectors.

1.11.4 Record results on an approved PEARL Evaluation Form.

1.12 Blown Fuse Trip Mechanism

1.12.1 Check blown fuse trip mechanism for proper operation.

1.12.2 Record results on an approved PEARL Evaluation Form.

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2 TESTING

2.1 Insulation Resistance

Consult manufacturer's instructions for any precautions before performing this test.

2.1.1 Perform an insulation resistance at test values specified in Table 2 of Section 6000 as follows:

2.1.1.1 Circuit Breaker in the open position

2.1.1.1.1 Line to load

2.1.1.2 Circuit Breaker in the closed position

2.1.1.2.1 Phase to phase

2.1.1.2.2 Phase to ground

2.1.2 Correct for temperature, if necessary (Table 11).

2.1.3 Record results on an approved PEARL Evaluation Form.

2.1.4 Compare test results to manufacturer's recommendations or Table 2 of Section 6000.

2.2 Contact Resistance

2.2.1 Perform a contact resistance, millivolt drop test or watt-loss test from line to load on each phase of a closed circuit breaker.

2.2.2 Record results on an approved PEARL Evaluation Form.

2.2.3 Compare test results to manufacturer's recommendations.

2.2.4 A PEARL recognized method is comparing the test results of each pole. Results should be within 50% for any of the poles. Any industrial standard used shall provide at least the same integrity as the PEARL recognized standard of comparing the test results of each pole and ensuring that they are within 50% of each other.

2.3 Time Overcurrent (Long-Time) Trip Test

2.3.1 Perform a pickup test, if applicable.

2.3.2 Perform a time overcurrent trip test (recommend using 300% of rating) to the circuit breaker, if applicable.

2.3.3 Use specific length and size of wire that meet or exceeds manufacturer's guidelines or NEC, Article 310, Table 310.17.

2.3.3 Record results on an approved PEARL Evaluation Form.

2.3.4 Compare results to manufacturer's recommendations.

2.4 Short-Time Trip Test

2.4.1 Perform a short-time pickup test.

2.4.2 Perform a short-time overcurrent trip test (recommend using 150% of short-time setting) to the circuit breaker, if applicable.

2.4.3 Record results on an approved PEARL Evaluation Form.

2.4.4 Compare results to manufacturer's recommendations.

2.5 Instantaneous Overcurrent Trip Test

2.5.1 Perform an instantaneous pickup test.

2.5.2 Perform an instantaneous overcurrent trip test to the circuit breaker, if applicable.

2.5.2 Record results on an approved PEARL Evaluation Form.

2.5.3 Compare results to manufacturer's recommendations.

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- 2.6 Ground Fault Trip Test**
 - 2.6.1 Perform a ground fault pickup test.
 - 2.6.2 Perform a ground fault trip test (recommend using 150% of ground fault setting) to the circuit breaker, if applicable.
 - 2.6.3 Record results on an approved PEARL Evaluation Form.
 - 2.6.4 Compare results to manufacturer's recommendations.
- 2.7 Thermal Memory Feature**
 - 2.7.1 Test the thermal memory feature of the circuit breaker, if applicable.
 - 2.7.2 Record results on an approved PEARL Evaluation Form.
 - 2.7.3 Compare results to manufacturer's recommendations.
- 2.8 Zone Interlock Feature**
 - 2.8.1 Test the zone interlock feature of the circuit breaker, if applicable.
 - 2.8.2 Record results on an approved PEARL Evaluation Form.
 - 2.8.3 Compare results to manufacturer's recommendations.
- 2.9 Shunt Trip Test**
 - 2.9.1 Close circuit breaker.
 - 2.9.2 Connect appropriate voltage source to shunt trip input leads.
 - 2.9.3 Increase voltage until shunt trip unit operates. Verify that the device operates properly at its minimum rated voltage.
 - 2.9.4 Record results on an approved PEARL Evaluation Form.
- 2.10 Undervoltage Unit**
 - 2.10.1 Connect voltage source to undervoltage input leads.
 - 2.10.2 Apply rated voltage to the undervoltage unit.
 - 2.10.3 Close circuit breaker.
 - 2.10.4 Decrease voltage until undervoltage unit operates and trips the circuit breaker.
 - 2.10.5 Verify that the device operates properly within its rated voltage range.
 - 2.10.6 Record results on an approved PEARL Evaluation Form.

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III RECONDITION PROCEDURES

The following procedures are in a recommended order and are required to recondition this product. PEARL recognizes that, based upon actual product design and/or as found condition, some of these procedures may not be applicable. The testing requirement must be completed before the product can be labeled as a PEARL reconditioned product.

1 RECONDITIONING

1.1 Case and Interphase Barriers

1.1.1 Clean case.

1.1.2 Clean interphase barriers.

1.2 Operating Mechanism

1.2.1 Disassemble the operating mechanism, as necessary.

1.2.2 Clean mechanism.

1.2.3 Replace any defective parts.

1.2.4 Replate operating mechanism parts, as necessary.

1.2.5 Assemble operating mechanism.

1.2.6 Apply proper lubrication.

1.2.7 Manually operate circuit breaker a minimum of five (5) times while checking for proper operation of the quick-make and quick-break feature.

1.3 Arc Extinguishers/Chutes

1.3.1 Remove arc extinguishers.

1.3.2 Clean arc extinguishers.

1.3.3 Replace any defective arc extinguishers.

1.3.4 Assemble arc extinguishers.

1.4 Arcing Contacts

1.4.1 Remove and replace any defective arcing contacts.

1.4.2 Stationary arcing contacts.

1.4.2.1 Clean and dress.

1.4.2.2 Remove and replate, as necessary.

1.4.2.3 Replace contacts.

1.4.3 Movable arcing contacts.

1.4.3.1 Clean and dress.

1.4.3.2 Remove and replate, as necessary.

1.4.3.3 Replace contacts.

1.4.4 Check for proper wipe and alignment.

1.4.5 Check for proper torque on connections.

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- 1.5 Main Contacts**
 - 1.5.1** Remove and replace any defective main contacts.
 - 1.5.2** Stationary main contacts.
 - 1.5.2.1** Clean and dress.
 - 1.5.2.2** Remove and replate, as necessary.
 - 1.5.2.3** Replace contacts.
 - 1.5.3** Movable main contacts.
 - 1.5.3.1** Clean and dress.
 - 1.5.3.2** Remove and replate, as necessary.
 - 1.5.3.3** Replace contacts.
 - 1.5.4** Check for proper wipe and alignment.
 - 1.5.5** Check for proper torque on connections.
- 1.6 Current Carrying Components**
 - 1.6.1** Line and load connections.
 - 1.6.1.1** Clean and degrease.
 - 1.6.1.2** Replate, as necessary.
 - 1.6.2** Hinge/pivot joints.
 - 1.6.2.1** Clean and degrease.
 - 1.6.2.2** Replate, as necessary.
 - 1.6.3** Other current carrying components.
 - 1.6.3.1** Clean and degrease.
 - 1.6.3.2** Replate, as necessary.
- 1.7 Breaker Solid State Protection Trip Unit**
 - 1.7.1** Repair or replace the solid state protection trip unit if the unit failed to operate as designed for any of the following tests:
 - 1.7.1.1** Long-time
 - 1.7.1.2** Short-time
 - 1.7.1.3** Instantaneous
 - 1.7.1.4** Ground fault
 - 1.7.1.5** Thermal memory
 - 1.7.1.6** Zone interlock
- 1.8 Shunt Trip Unit**
 - 1.8.1** Replace or repair any defective shut trip unit.
 - 1.8.2** Adjust any shunt trip unit to operate within the design characteristic based on the manufacturer's recommendations. In the absence of manufacturer's instructions, these adjustments will be based on a procedure that will ensure the original manufacturer's design.
 - 1.8.3** Record results on an approved PEARL Reconditioning Test Form.

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- 1.9 Undervoltage Trip Unit**
 - 1.9.1 Replace or repair any defective undervoltage trip unit.
 - 1.9.2 Adjust any undervoltage trip unit to operate within the design characteristic based upon the manufacturer's recommendations. In the absence of a manufacturer's instructions, these adjustments will be based upon a procedure that will ensure the original manufacturer's design.
 - 1.9.3 Record results on an approved PEARL Reconditioning Test Form.
- 1.10 Blown Fuse Trip Mechanism**
 - 1.10.1 Replace or repair any defective blown fuse trip mechanism unit.
 - 1.10.2 Ensure blown fuse trip mechanism will trip breaker.
 - 1.10.3 Record results on an approved PEARL Reconditioning Test Form.
- 1.11 Checks and adjustments**
 - 1.11.1 Check arcing contacts for proper wipe, pressure and gap.
 - 1.11.2 Check main contacts for proper wipe, pressure and gap.
 - 1.11.3 Make all adjustments per manufacturer's instructions. In the absence of a manufacturer's instructions, these adjustments will be based upon procedures that will ensure the original manufacturer's design.
 - 1.11.4 The checks and adjustments must be within the guidelines recommended in order for the product to become a PEARL labeled product.
 - 1.11.5 Record results on an approved PEARL Reconditioning Test Form.
- 1.12 Torque**
 - 1.12.1 Check all screw and bolt connections for the proper torque per manufacturer's recommendations or Table 1 of Section 6000.
 - 1.12.2 Record results on an approved PEARL Reconditioning Test Form.
- 1.13 Final Assembly**
 - 1.13.1 Ensure that the nameplate/label data is complete, correct and legible.

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2 TESTING

2.1 Insulation Resistance

Consult manufacturer's instructions for any precautions before performing this test.

2.1.1 Perform an insulation resistance at test values specified in Table 2 of Section 6000 as follows:

2.1.1.1 Circuit Breaker in the open position

2.1.1.1.1 Line to load

2.1.1.1.2 Line to ground

2.1.1.1.3 Load to ground

2.1.1.1.4 Phase to phase on line side

2.1.1.1.5 Phase to phase on load side

2.1.1.2 Circuit Breaker in the closed position

2.1.1.2.1 Phase to phase

2.1.1.2.2 Phase to ground

2.1.2 Correct for temperature, if necessary (Table 11).

2.1.3 Record results on an approved PEARL Reconditioning Test Form.

2.1.4 Compare results to manufacturer's recommendations or Table 2 of Section 6000.

2.1.5 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.

2.2 Contact Resistance

2.2.1 Perform a contact resistance, millivolt drop test or watt-loss test from line to load on each phase of a closed circuit breaker.

2.2.2 Record results on an approved PEARL Reconditioning Test Form.

2.2.3 Compare test results to manufacturer's recommendations.

2.2.4 A PEARL recognized method is comparing the test results of each pole. Results should be within 50% for any of the poles. Any industrial standard used shall provide at least the same integrity as the PEARL recognized standard of comparing the test results of each pole and ensuring that they are within 50% of each other.

2.2.5 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.

2.3 Time Overcurrent (Long-Time) Trip Test

2.3.1 Perform a pickup test, if applicable.

2.3.2 Perform a time overcurrent trip test (recommend using 300% of rating) to the circuit breaker, if applicable.

2.3.3 Use specific length and size of wire that meet or exceeds manufacturer's guidelines or NEC, Article 310, Table 310.17.

2.3.4 Record results on appropriate PEARL Reconditioning Test Form.

2.3.5 Compare results to manufacturer's recommendations.

2.3.6 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.

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- 2.4 Short-Time Trip Test**
 - 2.4.1 Perform a short-time pickup test.
 - 2.4.2 Perform a short-time overcurrent trip test (recommend using 150% of short-time setting) to the circuit breaker, if applicable.
 - 2.4.3 Record results on an approved PEARL Reconditioning Test Form
 - 2.4.4 Compare results to manufacturer's recommendations.
 - 2.4.5 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.5 Instantaneous Overcurrent Trip Test**
 - 2.5.1 Perform an instantaneous pickup test.
 - 2.5.2 Perform an instantaneous overcurrent trip test to the circuit breaker, if applicable.
 - 2.5.2 Record results on an approved PEARL Reconditioning Test Form.
 - 2.5.3 Compare results to manufacturer's recommendations.
 - 2.5.4 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.6 Ground Fault Trip Test**
 - 2.6.1 Perform a ground fault pickup test.
 - 2.6.2 Perform a ground fault trip test (recommend using 150% of ground fault setting) to the circuit breaker, if applicable.
 - 2.6.3 Record results on an approved PEARL Reconditioning Test Form.
 - 2.6.4 Compare results to manufacturer's recommendations.
 - 2.6.5 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.7 Thermal Memory Feature**
 - 2.7.1 Test the thermal memory feature of the circuit breaker, if applicable.
 - 2.7.2 Record results on an approved PEARL Reconditioning Test Form.
 - 2.7.3 Compare results to manufacturer's recommendations.
 - 2.7.4 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.8 Zone Interlock Feature**
 - 2.8.1 Test the zone interlock feature of the circuit breaker, if applicable.
 - 2.8.2 Record results on appropriate PEARL Reconditioning Test Form.
 - 2.8.3 Compare results to manufacturer's recommendations.
 - 2.8.4 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.9 Shunt Trip Test**
 - 2.9.1 Close switch.
 - 2.9.2 Connect appropriate voltage source to shunt trip input leads.
 - 2.9.3 Increase voltage until shunt trip unit operates. Verify that the device operates properly at its minimum rated voltage recommended by the manufacturer.
 - 2.9.4 Operate the Shunt trip five (5) operations tripping the circuit breaker.
 - 2.9.5 Record results on an approved PEARL Reconditioning Test Form.

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2.10 Blown Fuse Indicator Device

- 2.10.1 Connect voltage source to fuse trip indicator input leads for A phase (left pole).
- 2.10.2 Close switch.
- 2.10.3 Apply rated voltage to the fuse trip indicator unit for A phase.
- 2.10.4 Ensure that switch trips (opens) and fuse indicator trip unit for A phase shows proper trip indicator, attempt to close tripped switch (Note - switch should not close).
- 2.10.5 Repeat for B phase (center pole) and C phase (right pole).
- 2.10.6 Compare results to manufacturer's recommendations.
- 2.10.7 Record results on an approved PEARL Reconditioning Test Form.

2.11 Undervoltage Unit

- 2.11.1 Connect voltage source to undervoltage input leads.
- 2.11.2 Apply rated voltage to the undervoltage unit.
- 2.11.3 Close circuit breaker.
- 2.11.4 Decrease voltage until undervoltage unit operates and trips the circuit breaker.
- 2.11.5 Verify that the device operates properly within its rated voltage range.
- 2.11.6 Operate the undervoltage release unit five (5) operations tripping the circuit breaker.
- 2.11.7 Record results on an approved PEARL Reconditioning Test Form.

2.12 Final Operation

- 2.12.1 Ensure that all components, structures, devices and assemblies are complete and equipment is ready for service prior to beginning operations.
- 2.12.2 Manually operate switch a minimum of ten (10) times while checking for proper operation of the quick-make and quick-break feature.
- 2.12.3 Electrically trip the disconnect switch a minimum of ten (10) times while checking for proper operation.
- 2.12.4 All devices must operate properly in order for the product to become a PEARL labeled product.
- 2.12.5 Record results on appropriate PEARL Reconditioning Test Form.

IV PEARL CERTIFICATION

This product has now been reconditioned under the PEARL Reconditioning Standard. The blue PEARL Reconditioning Quality Seal may now be placed on the device.