

PEARL Reconditioning Standards			
MEDIUM VOLTAGE CONTACTORS VACUUM	Revision		
	Standard	Number	Date
	2260	5	11-2008

This standard is designed to verify that a medium voltage vacuum contactor is in a safe and reliable operating condition based upon the design of the original manufacturer at the time of manufacturing. PEARL testing does not verify the claims of the original equipment manufacturer as to the validity of its design criteria. In the event that the device is not in this condition then this standard cannot be used and the PEARL Reconditioning Standard needs to be followed.

PEARL does not warrant, guarantee or make any representation regarding the correctness of specifications, use for any particular purpose, quality or extent of testing, accuracy, or reliability as to any equipment, products or documentation referenced herein.

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 5: Overpotential Test Voltages for Non-Inductive Electrical Apparatus
- Table 7: Power Factor/Dissipation Factor Recommended Test Voltage Values
- Table 11: Insulation resistance and test temperature conversion to 20°C values.

I TEST EQUIPMENT

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

1. Insulation Resistance Test Set (Megohmmeter) 1000 Vdc minimum
2. AC or DC Overpotential Test Set (Hipot)

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

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

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II EVALUATION

The following procedures shall be used to determine the condition of a medium voltage vacuum contactor under this standard.

1 INSPECTION

1.1 Frame

- 1.1.1 Ensure that the nameplate data is legible.
- 1.1.2 Ensure that the third party listing service label is legible.
- 1.1.3 Inspect for missing screws, bolts, nuts, fasteners, retainers and keepers.
- 1.1.4 Inspect for rust and corrosion.
- 1.1.5 Inspect ground connection for excessive and inappropriate lubrication.
- 1.1.6 Inspect primary disconnects/stabs for excessive and inappropriate lubrication, signs of overheating, and missing and defective parts.
- 1.1.7 Inspect secondary disconnects/stabs for excessive and inappropriate lubrication, signs of overheating, and missing and defective parts.
- 1.1.8 Inspect interference interface for correct position based on frame rating.
- 1.1.9 Inspect insulation structure for signs of overheating and deterioration.
- 1.1.10 Record results on an approved PEARL Evaluation Form.

1.2 Close Coil

- 1.2.1 Inspect for signs of rust and corrosion.
- 1.2.2 Inspect for overheating.
- 1.2.3 Inspect for missing screws, bolts, nuts, fasteners, retainers and keepers.
- 1.2.4 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 charging motor, if applicable.
- 1.3.4 Inspect control relays.
- 1.3.5 Inspect spring release relay, if applicable.
- 1.3.6 Inspect closing springs, if applicable.
- 1.3.7 Inspect opening springs, if applicable.
- 1.3.8 Inspect closing coil, if applicable.
- 1.3.9 Inspect insulating links (push rods).
- 1.3.10 Inspect for missing screws, bolts, nuts, fasteners, retainers and keepers.
- 1.3.11 Record results on an approved PEARL Evaluation Form.

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- 1.4 Interphase Barriers**
 - 1.4.1 Inspect for dust, dirt, and foreign materials.
 - 1.4.2 Inspect for chips, cracks, and deterioration.
 - 1.4.3 Inspect for tracking.
 - 1.4.4 Inspect for overheating.
 - 1.4.5 Record results on an approved PEARL Evaluation Form.
- 1.5 Vacuum Bottle**
 - 1.5.1 Inspect for cracks and chips.
 - 1.5.2 Check erosion gap on each phase if available.
 - 1.5.3 Record results on an approved PEARL Evaluation Form.
- 1.6 Fuse Assembly**
 - 1.6.1 Check fuse for proper rating per starter nameplate.
 - 1.6.2 Inspect for missing screws, defective parts, bolts, nuts, fasteners, retainers and keepers.
 - 1.6.3 Inspect for rust and corrosion.
 - 1.6.4 Inspect line and load clips for signs of overheating, and missing and defective parts.
 - 1.6.5 Inspect the fuse clips for proper tension.
 - 1.6.6 Inspect all insulators for defects, cracks, chips, and signs of tracking.
 - 1.6.7 Record results on an approved PEARL Evaluation Form.
- 1.7 Racking/Drawout Mechanism**
 - 1.7.1 Inspect for signs of rust and corrosion.
 - 1.7.2 Inspect for excessive and inappropriate lubrication.
 - 1.7.3 Inspect for missing screws, bolts, nuts, fasteners, retainers and keepers.
 - 1.7.4 Record results on an approved PEARL Evaluation Form.
- 1.8 Current Carrying Components**
 - 1.8.1 Inspect line and load connections for signs of overheating.
 - 1.8.2 Inspect line and load connections for missing and defective parts.
 - 1.8.3 Inspect hinge/pivot joints for signs of overheating.
 - 1.8.4 Inspect hinge/pivot joints for missing and defective parts.
 - 1.8.5 Inspect any other current carrying components for signs of overheating.
 - 1.8.6 Inspect any other current carrying components for missing and defective parts.
 - 1.8.7 Record results on an approved PEARL Evaluation Form.
- 1.9 Interlocks**
 - 1.9.1 Ensure that all interlocks all present.
 - 1.9.2 Record results on an approved PEARL Evaluation Form.
- 1.10 Limit Switches**
 - 1.10.1 Inspect all limit switches for proper operation.
 - 1.10.2 Check all terminal connections.
 - 1.10.3 Inspect for chips, cracks and defective limit switch cases.
 - 1.10.4 Record results on an approved PEARL Evaluation Form.

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- 1.11 Auxiliary/ Secondary Contact Block**
 - 1.11.1 Inspect contactor auxiliary contact block for proper operation.
 - 1.11.2 Check all terminal connections.
 - 1.11.3 Inspect for chips, cracks and defective auxiliary contact block assembly.
 - 1.11.4 Record results on an approved PEARL Evaluation Form.
- 1.12 Control Power Transformer**
 - 1.12.1 Inspect for signs of overheating and deteriorated insulation.
 - 1.12.2 Inspect control power fuses for proper ratings.
 - 1.12.3 Inspect for loose connections.
 - 1.12.4 Inspect for proper tension on fuse clips.
 - 1.12.5 Record results on an approved PEARL Evaluation Form.
- 1.13 Control Wiring**
 - 1.13.1 Inspect for overheating.
 - 1.13.2 Inspect for damage and deteriorated insulation.
 - 1.13.3 Check for loose or defective terminal connectors.
 - 1.13.4 Record results on an approved PEARL Evaluation Form.
- 1.14 Operation**
 - 1.14.1 Operate racking/drawout mechanism three (3) times while checking for smooth operation.
 - 1.14.2 Electrically operate (close/open) contactor five (5) times.
 - 1.14.3 Record results on an approved PEARL Evaluation Form.

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2 TESTING

2.1. Insulation Resistance

- 2.1.1** Perform an insulation resistance at test values specified in Table 2 of Section 6000 as follows:
- 2.1.1.1** Contactor in the open position
 - 2.1.1.1.1** Line to load
 - 2.1.1.2** Contactor 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 results to manufacturer's recommendations or industrial standards (Table 2).

Either Test; the “Overpotential Test” (Step 2.2) or the “Power Factor Test” (Step 2.3) must be performed. It is not a requirement to do both.

2.2 Overpotential Test

- 2.2.1** Perform an overpotential test at test voltage specified in Table 5 as follows:
- 2.2.1.1** Contactor in the open position with arc chutes installed
 - 2.2.1.1.1** Line to load
 - 2.2.1.1.2** Line to ground
 - 2.2.1.1.3** Load to ground
 - 2.2.1.2** Contactor in the closed position
 - 2.2.1.2.1** Phase to phase
 - 2.2.1.2.2** Phase to ground
- 2.2.2** Record results on an approved PEARL Evaluation Form.
- 2.2.3** Compare results to manufacturer's guidelines or industrial standards.

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2.3 Power Factor/Dissipation Factor Test

2.3.1 "A" Phase test

- 2.3.1.1 Perform a power factor test at rated voltage or below:
- 2.3.1.2 Contactor is in the OPEN position with arc chutes installed.
- 2.3.1.3 Connect the HIGH voltage test lead to the line side of the "A" phase.
- 2.3.1.4 Connect the LOW voltage test lead to the load side of the "A" phase.
- 2.3.1.5 Connect the GROUND test lead to the frame of the contactor.
- 2.3.1.6 Run a power/dissipation factor test in the "GUARD" mode.
 - 2.3.1.6.1 This is the "A-phase line to ground".
 - 2.3.1.6.2 Correct for temperature, if necessary. Refer to test equipment manufacturer's guidelines.
 - 2.3.1.6.3 Record results on an approved PEARL Evaluation Form.
- 2.3.1.7 Run a power/dissipation factor test in the "UST" mode.
 - 2.3.1.7.1 This is the "A-phase line to load".
 - 2.3.1.7.2 Correct for temperature, if necessary. Refer to test equipment manufacturer's guidelines.
 - 2.3.1.7.3 Record results on an approved PEARL Evaluation Form.
- 2.3.1.8 Move the HIGH voltage test lead to the load side of the "A" phase and the LOW voltage test lead to the line side of the "A" phase.
- 2.3.1.9 Run a power/dissipation factor test in the "GUARD" mode.
 - 2.3.1.9.1 This is the "A-phase load to ground".
 - 2.3.1.9.2 Correct for temperature, if necessary. Refer to test equipment manufacturer's guidelines.
 - 2.3.1.9.3 Record results on an approved PEARL Evaluation Form.

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2.3.2 “B” Phase test

- 2.3.2.1** Perform a power factor test at rated voltage or below:
- 2.3.2.2** Contactor is in the OPEN position with arc chutes installed.
- 2.3.2.3** Connect the HIGH voltage test lead to the line side of the “B” phase.
- 2.3.2.4** Connect the LOW voltage test lead to the load side of the “B” phase.
- 2.3.2.5** Connect the GROUND test lead to the frame of the contactor.
- 2.3.2.6** Run a power/dissipation factor test in the “GUARD” mode.
 - 2.3.2.6.1** This is the “B-phase line to ground”.
 - 2.3.2.6.2** Correct for temperature, if necessary. Refer to test equipment manufacturer’s guidelines.
 - 2.3.2.6.3** Record results on an approved PEARL Evaluation Form.
- 2.3.2.7** Run a power/dissipation factor test in the “UST” mode.
 - 2.3.2.7.1** This is the “B-phase line to load”.
 - 2.3.2.7.2** Correct for temperature, if necessary. Refer to test equipment manufacturer’s guidelines.
 - 2.3.2.7.3** Record results on an approved PEARL Evaluation Form.
- 2.3.2.8** Move the HIGH voltage test lead to the load side of the “B” phase and the LOW voltage test lead to the line side of the “B” phase.
- 2.3.2.9** Run a power/dissipation factor test in the “GUARD” mode.
 - 2.3.2.9.1** This is the “B-phase load to ground”.
 - 2.3.2.9.2** Correct for temperature, if necessary. Refer to test equipment manufacturer’s guidelines.
 - 2.3.2.9.3** Record results on an approved PEARL Evaluation Form.

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2.3.3 “C” Phase test

- 2.3.3.1 Perform a power factor test at rated voltage or below:
- 2.3.3.2 Contactor is in the OPEN position with arc chutes installed.
- 2.3.3.3 Connect the HIGH voltage test lead to the line side of the “C” phase.
- 2.3.3.4 Connect the LOW voltage test lead to the load side of the “C” phase.
- 2.3.3.5 Connect the GROUND test lead to the frame of the contactor.
- 2.3.3.6 Run a power/dissipation factor test in the “GUARD” mode.
 - 2.3.3.6.1 This is the “C-phase line to ground”.
 - 2.3.3.6.2 Correct for temperature, if necessary. Refer to test equipment manufacturer’s guidelines.
 - 2.3.3.6.3 Record results on an approved PEARL Evaluation Form.
- 2.3.3.7 Run a power/dissipation factor test in the “UST” mode.
 - 2.3.3.7.1 This is the “C-phase line to load”.
 - 2.3.3.7.2 Correct for temperature, if necessary. Refer to test equipment manufacturer’s guidelines.
 - 2.3.3.7.3 Record results on an approved PEARL Evaluation Form.
- 2.3.3.8 Move the HIGH voltage test lead to the load side of the “C” phase and the LOW voltage test lead to the line side of the “C” phase.
- 2.3.3.9 Run a power/dissipation factor test in the “GUARD” mode.
 - 2.3.3.9.1 This is the “C-phase load to ground”.
 - 2.3.3.9.2 Correct for temperature, if necessary. Refer to test equipment manufacturer’s guidelines.
 - 2.3.3.9.3 Record results on an approved PEARL Evaluation Form.
- 2.3.4 Compare results to manufacturer's guidelines or industrial standards.

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2.4 Contact Resistance

- 2.4.1 Perform a contact resistance, millivolt drop test or watt-loss test from line to load on each phase of a closed contactor with the test points at the line and load primary stabs/disconnects.
- 2.4.2 Record results on an approved PEARL Evaluation Form.
- 2.4.3 Compare test results to manufacturer's recommendations.
- 2.4.4 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.

CAUTION

Check with manufacturer for radiation warnings.

2.5 Vacuum Bottle Integrity Test

- 2.5.1 Perform a vacuum bottle integrity test on each phase using specific manufacturer's literature guidelines for test voltage and test sets.
- 2.5.2 Starter in the open position - Line to Load using an overpotential test set.
- 2.5.3 Record results on an approved PEARL Evaluation Form.
- 2.5.4 Compare results to manufacturer's guidelines or company guidelines.

2.6 Timing

- 2.6.1 Perform a timing test on the close operation using the 52a contacts.
- 2.6.2 Perform a timing test on the open operation using the 52b contacts.
- 2.6.3 Record results on an approved PEARL Evaluation Form.
- 2.6.4 Compare with manufacturers recommendations.

NOTE: If the original equipment manufacturer has designed the parts to be field installed, then the devices may be replaced as necessary. Otherwise, if changes are made to the accessories then the PEARL Reconditioning Standards need to be followed.

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2.7 Checks and Adjustments

2.7.1 Make all checks and adjustments per manufacturer's recommendations. In the absence of a manufacturer's recommendations, any check or adjustment made will be based upon procedures that will ensure the original manufacturer's design.

2.7.2 All checks and adjustments must be within the guidelines recommended in order for the product to become a PEARL labeled product.

2.7.3 Record results on an approved PEARL Evaluation Form.

2.8 Torque

2.8.1 Check all screw and bolt connections for the proper torque per manufacturer's recommendations or Table 1 of Section 6000.

2.8.2 Record results on an approved PEARL Evaluation Form.

2.9 Final Operation

2.9.1 Ensure that all components, structures, devices and assemblies are complete and equipment is ready for service prior to beginning operations.

2.9.2 Manually operate the device a minimum of ten (10) times while checking for proper operation of the quick-make and quick-break feature.

2.9.3 Electrically operate (close/open) the device ten (10) times while checking for proper operation.

2.9.4 All devices must operate properly in order for the product to become a PEARL labeled product.

2.9.5 Record results on appropriate PEARL Evaluation Form.

2.9.6 Ensure that the nameplate/label data is complete, correct and legible.

3 EVALUATION REVIEW

In order for the device to be eligible for the Inspect & Test Quality Seal, the device needs to have passed all of the preceding Inspection (1) and Testing (2) points. Any failures in the process will require that the device be "Reconditioned" at which time the PEARL Reconditioning Standard needs to be followed.

III PEARL CERTIFICATION

This product has now been inspected and tested and has passed all tests under the PEARL Inspect & Test Standard. The green PEARL Inspect & Test Quality Seal may now be placed on the device.