

<i>PEARL Reconditioning Standards</i>			
<i>TIME DELAY OVERCURRENT RELAYS ELECTROMAGNETIC INDUCTION DISK</i>	<i>PROPOSED STANDARD</i>		
	<i>Standard</i>	<i>Number</i>	<i>Date</i>
	<i>1720</i>	<i>5</i>	<i>11-2008</i>

This standard is designed to verify that a time delay overcurrent relay based on the electromagnetic induction disk principal is in a safe and reliable operating condition. In the event that the relay is not in this condition then this standard will establish the reconditioning requirements. 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."

## **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 2 Insulation resistance and test values for electrical apparatus.
- Table 6 Transformer Insulation Resistance Test Value
- 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).

## **I TEST EQUIPMENT**

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

1. Insulation Resistance Test Set (Megohmmeter) 500 Vdc minimum
2. Multimeter
3. AC Current Supply with means of timing
4. DC Current 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 Inspect for dents.
- 1.1.2 Inspect for stripped relay terminal screws.
- 1.1.3 Inspect all current transformer shorting switches
- 1.1.4 Record results on an approved PEARL Evaluation Form.

#### 1.2 Cover

- 1.2.1 Inspect for cracked or broken cover glass.
- 1.2.2 Inspect cover gasket or pad
- 1.2.3 Inspect cover glass holders or tabs
- 1.2.4 Record results on an approved PEARL Evaluation Form.

#### 1.3 Induction Coil

- 1.3.1 Inspect for signs of overheating.
- 1.3.2 Inspect for signs of contamination.
- 1.3.3 Inspect terminals for signs of corrosion.
- 1.3.4 Record results on an approved PEARL Evaluation Form.

#### 1.4 Instantaneous Coil

- 1.4.1 Inspect for signs of overheating.
- 1.4.2 Inspect for signs of contamination.
- 1.4.3 Inspect terminals for signs of corrosion.
- 1.4.4 Record results on an approved PEARL Evaluation Form.

#### 1.5 Target & Seal-In Coil

- 1.5.1 Inspect for signs of overheating.
- 1.5.2 Inspect for signs of contamination.
- 1.5.3 Inspect terminals for signs of corrosion.
- 1.5.4 Record results on an approved PEARL Evaluation Form.

#### 1.6 Wiring

- 1.6.1 Inspect signs of overheating.
- 1.6.2 Inspect for signs of contamination.
- 1.6.3 Record results on an approved PEARL Evaluation Form.

#### 1.7 Relay Terminals

- 1.7.1 Inspect for missing screws
- 1.7.2 Check for stripped screws
- 1.7.3 Inspect for signs of overheating.
- 1.7.4 Inspect for signs of contamination.
- 1.7.5 Inspect for signs of corrosion.
- 1.7.6 Record results on an approved PEARL Evaluation Form.

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- 1.8 Contacts**
  - 1.8.1 Inspect signs of overheating.
  - 1.8.2 Inspect for signs of contamination.
  - 1.8.3 Record results on an approved PEARL Evaluation Form.
- 1.9 Disk**
  - 1.9.1 Inspect signs of overheating.
  - 1.9.2 Inspect for signs of contamination.
  - 1.9.3 Ensure disk is not bent
  - 1.9.4 Check for proper end play
  - 1.9.5 Record results on an approved PEARL Evaluation Form.
- 1.10 Spiral Spring**
  - 1.10.1 Inspect signs of overheating.
  - 1.10.2 Inspect for signs of contamination.
  - 1.10.3 Ensure spring is not bent
  - 1.10.4 Record results on an approved PEARL Evaluation Form.
- 1.11 Tap Block**
  - 1.11.1 Inspect signs of overheating.
  - 1.11.2 Inspect for signs of contamination.
  - 1.11.3 Ensure there are no stripped screw holes
  - 1.11.4 Record results on an approved PEARL Evaluation Form.

**2 TESTING**

- 2.1 Zero Check of the Time Dial**
  - 2.1.1 Adjust time dial until the induction unit contacts first touch
  - 2.1.2 Record time dial reading on an approved PEARL Evaluation Form.
- 2.2 Induction Unit Minimum Pickup**
  - 2.2.1 Set relay to minimum tap setting
  - 2.2.2 Set time dial to maximum setting.
  - 2.2.3 Connect ac current source to the induction coil
  - 2.2.4 Increase ac current until the disk begins to move
  - 2.2.5 Record induction unit pickup on an approved PEARL Evaluation Form.
- 2.3 Induction Unit Creep Test**
  - 2.3.1 Set relay to minimum tap setting
  - 2.3.2 Set time dial to maximum setting.
  - 2.3.3 Connect ac current source to the induction coil
  - 2.3.4 Set ac current to 105% of tap or manufacturers maximum pickup tolerance. Disk should continue to rotate until disk contacts close
  - 2.3.5 Record results on an approved PEARL Evaluation Form.

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- 2.4 Induction Unit Timing Test**
  - 2.4.1 Set relay to minimum tap setting
  - 2.4.2 Set time dial to maximum setting.
  - 2.4.3 Connect ac current source to the induction coil
  - 2.4.4 Perform three timing tests at different percentages of tap to verify the timing characteristic of the induction unit.
  - 2.4.5 Record induction unit timing results on an approved PEARL Evaluation Form.
- 2.5 Target and Seal-In Unit Functional Tests**
  - 2.5.1 Set relay to minimum tap setting
  - 2.5.2 Set time dial to one.
  - 2.5.3 Connect ac current source to the induction coil
  - 2.5.4 Connect dc current source to the induction coil
  - 2.5.5 Apply ac current of 150% of tap to induction unit coil.
  - 2.5.6 Ensure induction unit contacts are close
  - 2.5.7 Increase dc current to target and seal-in unit until pickup is achieved.
  - 2.5.8 Record target and seal-in unit pickup results on an approved PEARL Evaluation Form.
  - 2.5.9 Set dc current to tap value setting
  - 2.5.10 Remove ac current to induction unit coil.
  - 2.5.11 Record target and seal-in unit seal-in results on an approved PEARL Evaluation Form.
  - 2.5.12 Decrease dc current until the target and seal-in unit dropout is achieved.
  - 2.5.13 Record target and seal-in unit dropout results on an approved PEARL Evaluation Form.
- 2.6 Instantaneous Unit Pickup Current – Minimum Scale Setting**
  - 2.6.1 Connect ac current source to the instantaneous coil
  - 2.6.2 Increase ac current until instantaneous unit pickup is achieved.
  - 2.6.3 Record as Pickup Current – minimum scale setting.
  - 2.6.4 Remove current
  - 2.6.5 Compare test value for Pickup Current – minimum scale setting with manufacturers tolerance for relay pickup or +/- 10 % of scale setting.
  - 2.6.6 Record instantaneous results on an approved PEARL Evaluation Form.

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- 2.7 Instantaneous Unit Pickup Current – Maximum Scale Setting**
  - 2.7.1 Connect ac current source to the instantaneous coil
  - 2.7.2 Increase ac current until instantaneous unit pickup is achieved.
  - 2.7.3 Record as Pickup Current – maximum scale setting.
  - 2.7.4 Remove current
  - 2.7.5 Compare test value for Pickup Current – maximum scale setting with manufacturers tolerance for relay pickup or +/- 10 % of scale setting.
  - 2.7.6 Record instantaneous results on an approved PEARL Evaluation Form.
- 2.8 Instantaneous Operation Verification**
  - 2.8.1 Set. instantaneous to minimum scale setting
  - 2.8.2 Set ac current to 2 times scale setting
  - 2.8.3 Connect timing circuit to relay
  - 2.8.4 Apply ac current to relay
  - 2.8.5 Remove ac current if test set fails to reenergized
  - 2.8.6 Compare time of operation with manufacturer specification for instantaneous pickup time or 100 milliseconds or less.
  - 2.8.7 Record results on an approved PEARL Evaluation Form.
- 2.9 Insulation Resistance**
  - 2.9.1 Perform an insulation resistance test at test voltage specified by manufacturer or using a 500-volt dc megohmmeter.
  - 2.9.2 Record results on an approved PEARL Evaluation Form.
  - 2.9.3 Compare test results to manufacturer's recommendations or a minimum of 1 megohm.

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### III RECONDITIONING PROCEDURES

The following procedures are in a recommended order and are required to recondition this product. PEARL recognizes that, based on actual product design and 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 Cover

1.1.1 Clean all surfaces to remove any:

1.1.1.1 Dirt

1.1.1.2 Contamination

1.1.1.3 Corrosion.

1.1.1.4 Rust

1.1.1.5 Record results on an approved PEARL Reconditioning Test Form.

##### 1.2. Missing or Defective Components, Parts and Hardware

1.2.1 Replace or repair any missing or defective components, parts and hardware found during the inspection phase of this standard.

1.2.2 Replace any defective contact or contact assembly

1.2.3 Record results on an approved PEARL Reconditioning Test Form.

##### 1.3 Final Assembly

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

1.3.2 Record results on an approved PEARL Reconditioning Test Form.

#### 2 TESTING

##### 2.1 Zero Check of the Time Dial

2.1.1 Adjust time dial until the induction unit contacts first touch

2.1.2 If necessary adjust per manufacturer's recommendations and retest

2.1.3 Record time dial reading on an approved PEARL Reconditioning Test Form

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

##### 2.2 Induction Unit Minimum Pickup

2.2.1 Set relay to minimum tap setting

2.2.2 Set time dial to maximum setting.

2.2.3 Connect ac current source to the induction coil

2.2.4 Increase ac current until the disk begins to move

2.2.5 If necessary adjust per manufacturer's recommendations and retest

2.2.6 Record induction unit pickup on an approved PEARL Reconditioning Test Form.

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

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- 2.3 Induction Unit Creep Test**
  - 2.3.1 Set relay to minimum tap setting
  - 2.3.2 Set time dial to maximum setting.
  - 2.3.3 Connect ac current source to the induction coil
  - 2.3.4 Set ac current to 105% of tap or manufacturers maximum pickup tolerance. Disk should continue to rotate until disk contacts close
  - 2.3.5 If necessary adjust per manufacturer's recommendations and retest
  - 2.3.6 Record results on an approved PEARL Reconditioning Test Form.
  - 2.3.7 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.4 Induction Unit Timing Test**
  - 2.4.1 Set relay to minimum tap setting
  - 2.4.2 Set time dial to maximum setting.
  - 2.4.3 Connect ac current source to the induction coil
  - 2.4.4 Perform three timing tests at different percentages of tap to verify the timing characteristic of the induction unit.
  - 2.4.5 If necessary adjust per manufacturer's recommendations and retest
  - 2.4.6 Record induction unit timing results on an approved PEARL Reconditioning Test Form.
  - 2.4.7 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.5 Target and Seal-In Unit Functional Tests**
  - 2.5.1 Set relay to minimum tap setting
  - 2.5.2 Set time dial to one.
  - 2.5.3 Connect ac current source to the induction coil
  - 2.5.4 Connect dc current source to the induction coil
  - 2.5.5 Apply ac current of 150% of tap to induction unit coil.
  - 2.5.6 Ensure induction unit contacts are close
  - 2.5.7 Increase dc current to target and seal-in unit until pickup is achieved.
  - 2.5.8 Record target and seal-in unit pickup results on an approved PEARL Reconditioning Test Form
  - 2.5.9 Set dc current to tap value setting
  - 2.5.10 Remove ac current to induction unit coil.
  - 2.5.11 Record target and seal-in unit seal-in results on an approved PEARL Reconditioning Test Form
  - 2.5.12 Decrease dc current until the target and seal-in unit dropout is achieved.
  - 2.5.13 Record target and seal-in unit dropout results on an approved PEARL Reconditioning Test Form.
  - 2.5.14 If necessary adjust per manufacturer's recommendations and retest
  - 2.5.15 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.

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- 2.6 Instantaneous Unit Pickup Current – Minimum Scale Setting**
  - 2.6.1 Connect ac current source to the instantaneous coil
  - 2.6.2 Increase ac current until instantaneous unit pickup is achieved.
  - 2.6.3 Record as Pickup Current – minimum scale setting.
  - 2.6.4 Remove current
  - 2.6.5 Compare test value for Pickup Current – minimum scale setting with manufacturers tolerance for relay pickup or +/- 10 % of scale setting.
  - 2.6.6 If necessary adjust per manufacturer's recommendations and retest
  - 2.6.7 Record instantaneous results on an approved PEARL Reconditioning Test Form
  - 2.6.8 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.7 Instantaneous Unit Pickup Current – Maximum Scale Setting**
  - 2.7.1 Connect ac current source to the instantaneous coil
  - 2.7.2 Increase ac current until instantaneous unit pickup is achieved.
  - 2.7.3 Record as Pickup Current – maximum scale setting.
  - 2.7.4 Remove current
  - 2.7.5 Compare test value for Pickup Current – maximum scale setting with manufacturers tolerance for relay pickup or +/- 10 % of scale setting.
  - 2.7.6 If necessary adjust per manufacturer's recommendations and retest
  - 2.7.7 Record instantaneous results on an approved PEARL Reconditioning Test Form
  - 2.7.8 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.8 Instantaneous Operation Verification**
  - 2.8.1 Set. instantaneous to minimum scale setting
  - 2.8.2 Set ac current to 2 times scale setting
  - 2.8.3 Connect timing circuit to relay
  - 2.8.4 Apply ac current to relay
  - 2.8.5 Remove ac current if test set fails to deenergize
  - 2.8.6 Compare time of operation with manufacturer specification for instantaneous pickup time or 100 milliseconds or less.
  - 2.8.7 If necessary adjust per manufacturer's recommendations and retest
  - 2.8.8 Record results on an approved PEARL Reconditioning Test Form
  - 2.8.9 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.

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**2.9 Insulation Resistance**

- 2.9.1 Perform an insulation resistance test at test voltage specified by manufacturer or using a 500-volt dc megohmmeter.
- 2.9.2 Record results on an approved PEARL Reconditioning Test Form.
- 2.9.3 Compare test results to manufacturer's recommendations or a minimum of 1 megohm.
- 2.9.4 Record results on an approved PEARL Reconditioning Test Form.
- 2.9.5 Compare test results to manufacturer's recommendations or a minimum of 1 megaohm.
- 2.9.6 The test results must be within the guidelines recommended in order for the product to become a PEARL labeled product.
- 2.9.7 If necessary adjust per manufacturer's recommendations and retest.

**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.