Durability Testing for ENERGY STAR® Luminaires

September 20, 2002

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Overview

- Goals of the project
- Summary of first round table
  - Strawperson
  - Recommendations
- Pilot tests methodology
  - Temperature Testing
  - Stress Testing
- Pilot tests results
- Discussion
- Next steps

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Project Goals

- Investigate possible causes of premature failures with ENERGY STAR luminaires
- Develop testing method to minimize premature failures, based on these investigations

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First Roundtable

(October 31, 2001)

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Initial "Strawperson"

- **Assumption: Most premature failures are caused by lamp/ballast incompatibility or poor quality components, and stress test would help "weed out" bad products**
- **Action: Propose rapid-cycle testing method to weed out lamp ballast incompatibility**
  - **5 min on / 5 min off testing cycle, as per CFL testing requirements**

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First Roundtable Recommendations

- High ballast temperatures inside the fixtures are the most likely cause of premature failures
- Secondarily, poor quality components that do not meet ANSI specs

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Roundtable Suggestions for Pilot Temperature Testing

- Develop testing method to measure ballast temperature inside operating luminaire
- Contact ballast manufacturers
  - Where is most critical thermocouple mounting point?
  - What is max temp at that point?
- Focus on highly enclosed luminaires
  - Recessed downlights, CFL
  - Ceiling-mounted ("flush-mounted") CFL

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Pilot Tests

Temperature Testing: Goals

- Verify assumption that ballasts used in ENERGY STAR luminaires are commonly operated above recommended temperatures
- Establish testing procedure for luminaire manufacturers to follow, that will ensure proper temp operation

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Pilot Tests

Temperature Testing: apparatus

- Consulted existing temp. testing procedures for “normal” environments (UL 1598)
- Built apparatus for ceiling-mtd luminaires
- Custom-built each apparatus for recessed testing
- Developed automated monitoring procedure

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Pilot Tests

Temperature Testing: Sample Selection

- Initially consulted 2.0 list of products
- Updated with 3.1 list (starting April '02)
- Selected one product from each ENERGY STAR manufacturer, preferably:
  - Highest wattage
  - Smallest enclosure
  - Most widely available
  - Electronically ballasted (Magnetic, if none other available)

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Pilot Tests

Temperature Testing: Sample Selection

- Manufacturers not represented if:
  - Had no product that was CFL
  - Had no recessed or ceiling-mounted product
  - Was unwilling to cooperate
  - Unable to contact

Some samples donated; most, purchased

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Pilot Tests

Samples: Ceiling-mounted

Twenty-two ceiling-mounted samples:

- (10) electronically-ballasted, (12) magnetically-ballasted
- Lamp types:
  - (9) 13W single-bend CFL
  - (3) 13W double-bend CFL
  - (1) 18W double-bend CFL
  - (1) 32W triple-bend CFL
  - (8) circline, 2C, 2D (multiple wattages)

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Pilot Tests

Samples: Recessed

Seven recessed samples:

- All electronically-ballasted
- Lamp Types:
  - (2) 13W double-bend CFL
  - (1) 18W double-bend CFL
  - (2) 26W double-bend CFL
  - (2) 32W triple-bend CFL

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"What IS Maximum Ballast Temperature?"

Once samples arrived:

- **Disassembled to determine ballast manufacturer and product model #**
- **Ideally: contacted ballast manufacturer directly**
  - **Maximum case temperature**
  - **Location of critical measurement point(s)**
- **Realistically: several ballasts were "sealed," unlabeled, proprietary products**
  - **Inquiries routed through luminaire manufacturer**
- **For some products, officials unwilling/unable to provide information**

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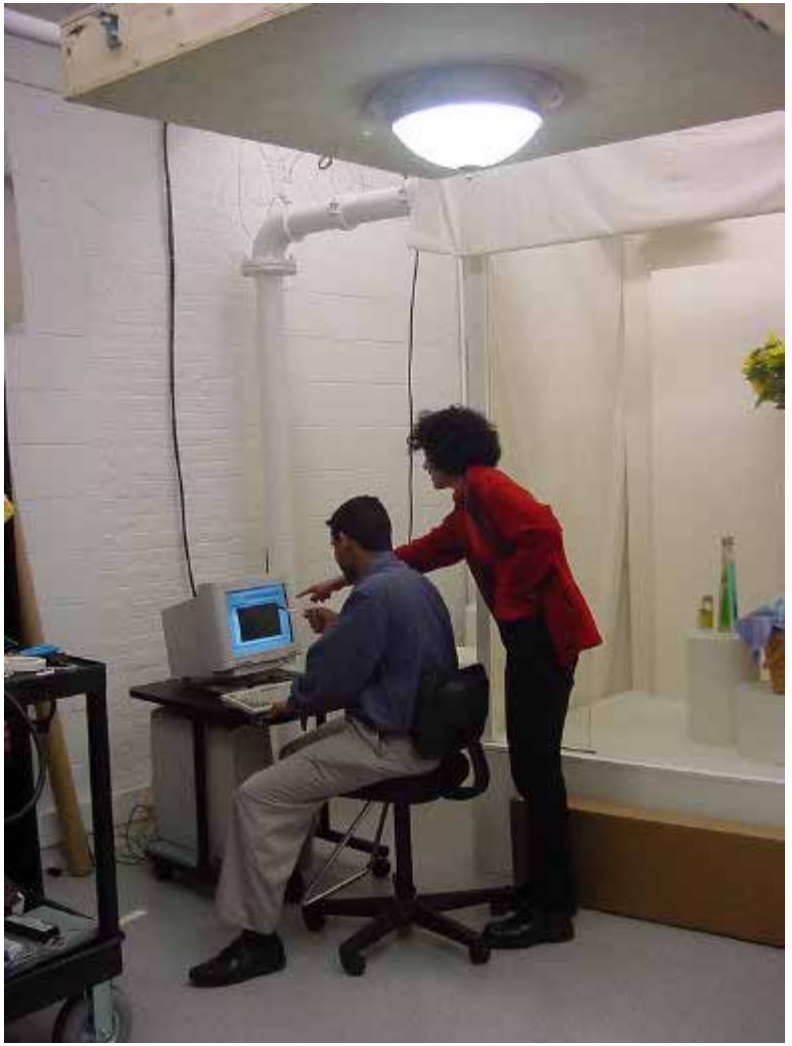
Temperature Testing



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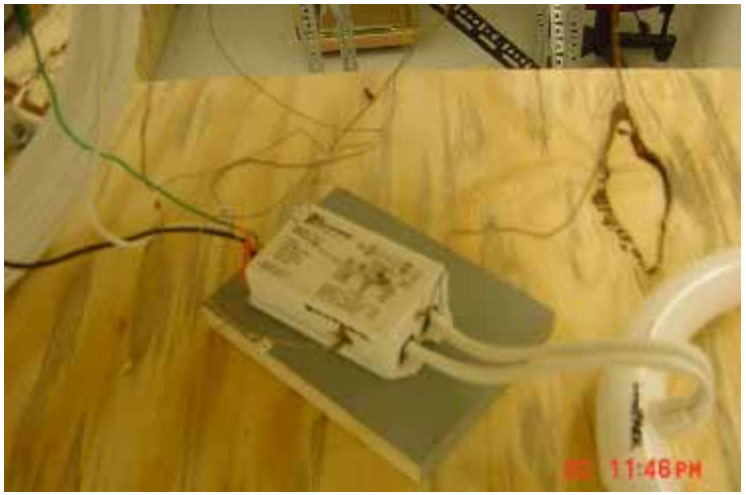
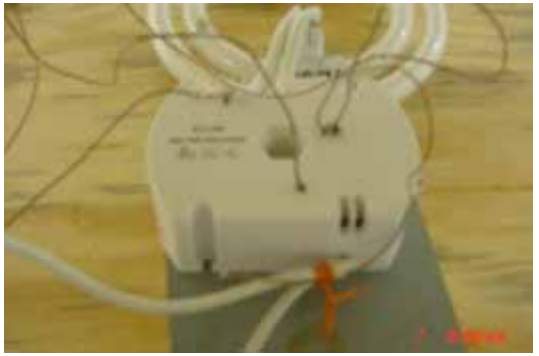
Temperature Testing (Ceiling Mounted)





"Closed"

"Open"

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Temperature Testing (Recessed)

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(Stay tuned for temperature results…)

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Stress Testing

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Stress Testing: Goal

Pilot Testing Goal :

- **Establish testing procedure for luminaire manufacturers to "stress" components (more quickly than standard life testing)**

Assumption: Premature ballast failures are also caused by substandard components that tend to fail quickly ("bathtub curve") or lamp/ballast incompatibility

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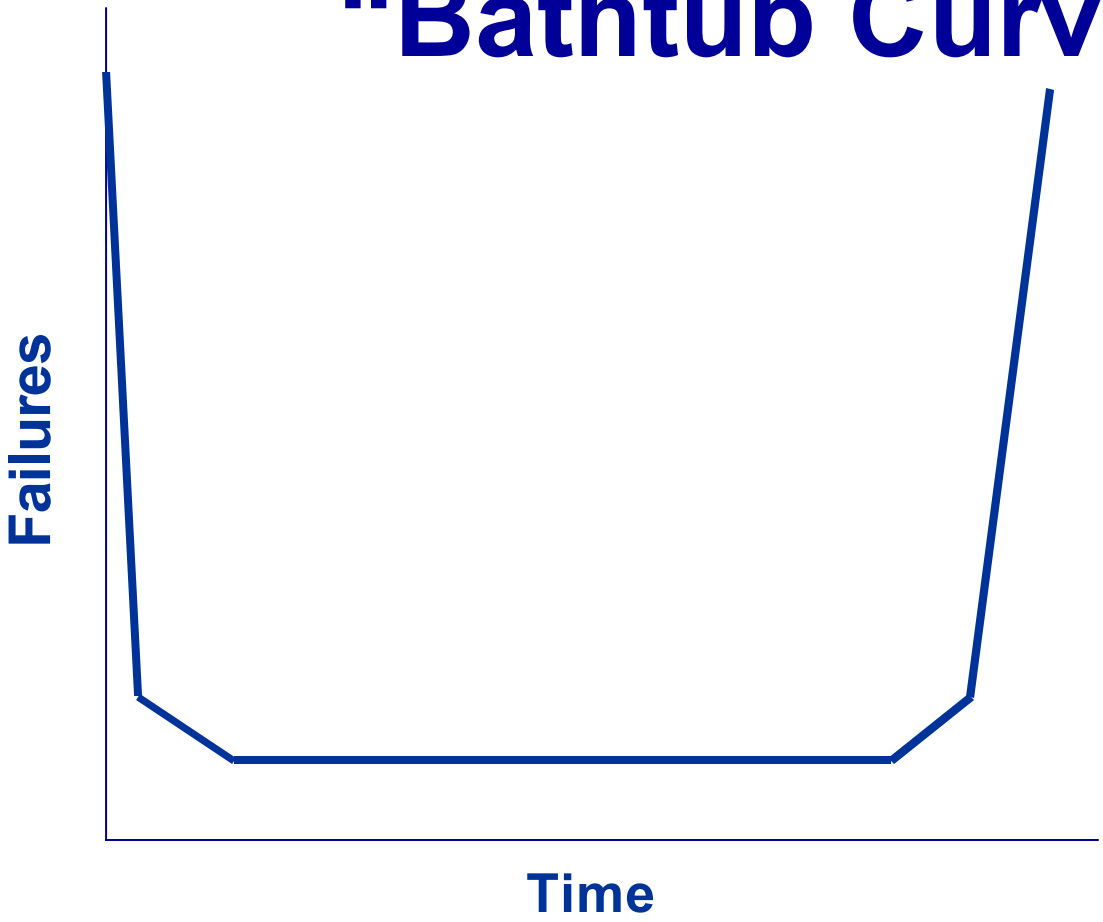
Stress Testing: "Bathtub Curve"



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Pilot Stress Testing Methodology

- 5 min on / 5 min off accelerated testing cycle
- 9 products with typical lamp/ballast combinations found in actual ENERGY STAR luminaires (types also used in temperature testing)
- 6 samples of each of each product
- Apparatus located off-site
- We will reassess longevity of testing when 50% of the samples of each product fail

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Stress testing
Sample lamp/ballast combinations

- 13W single-bend CFL, magnetic
- 13W double-bend CFL, electronic
- 18W double-bend CFL, electronic
- 26W triple-bend CFL, electronic
- 32W “dairy queen” CFL
- Multiple circline or equiv.
- 2’ T8, electronic

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Pilot Testing Results

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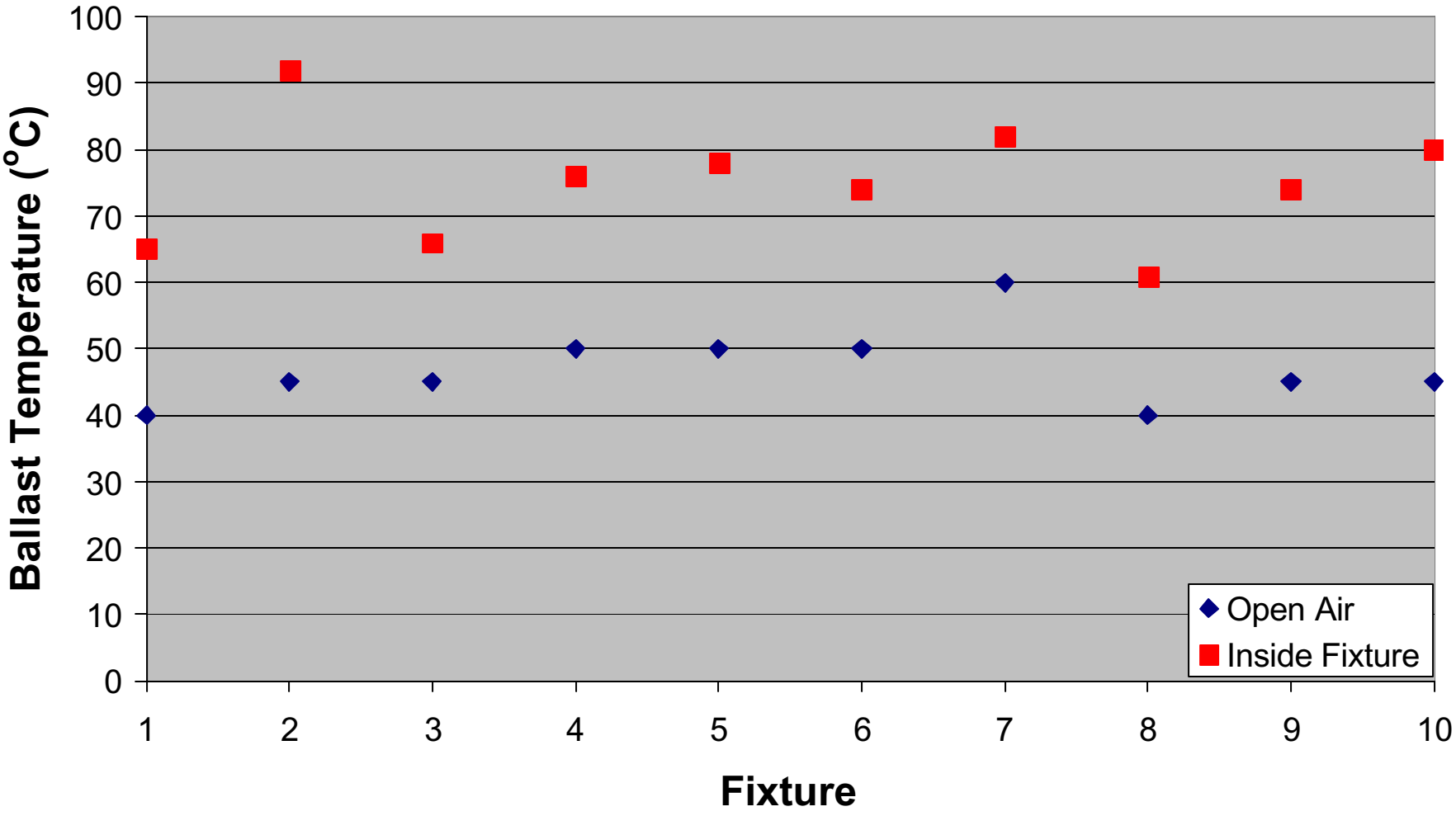
Thermal Test

Ceiling Mounted Fixtures with Electronic Ballasts



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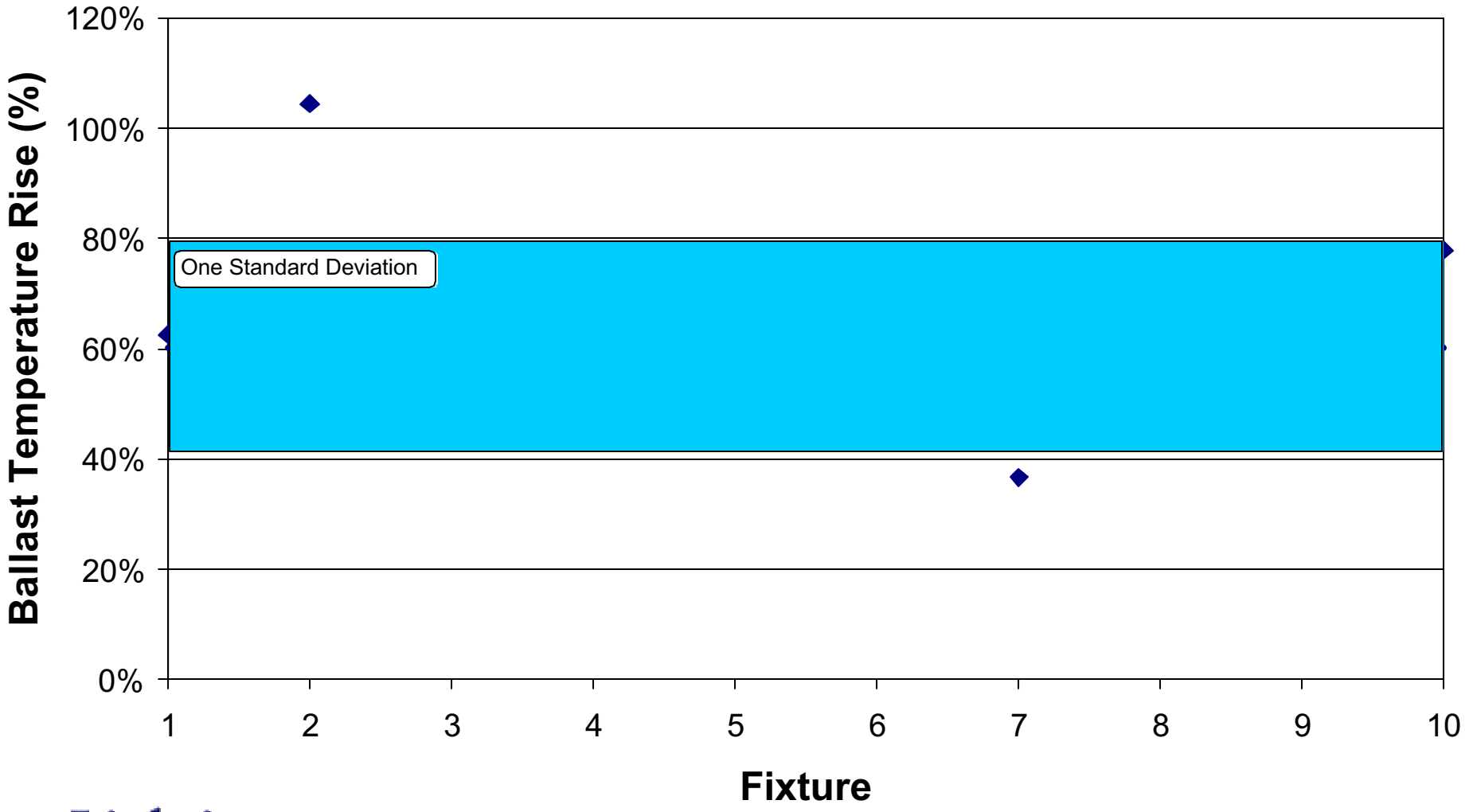
Thermal Test

Ceiling Mounted Fixtures with Electronic Ballasts



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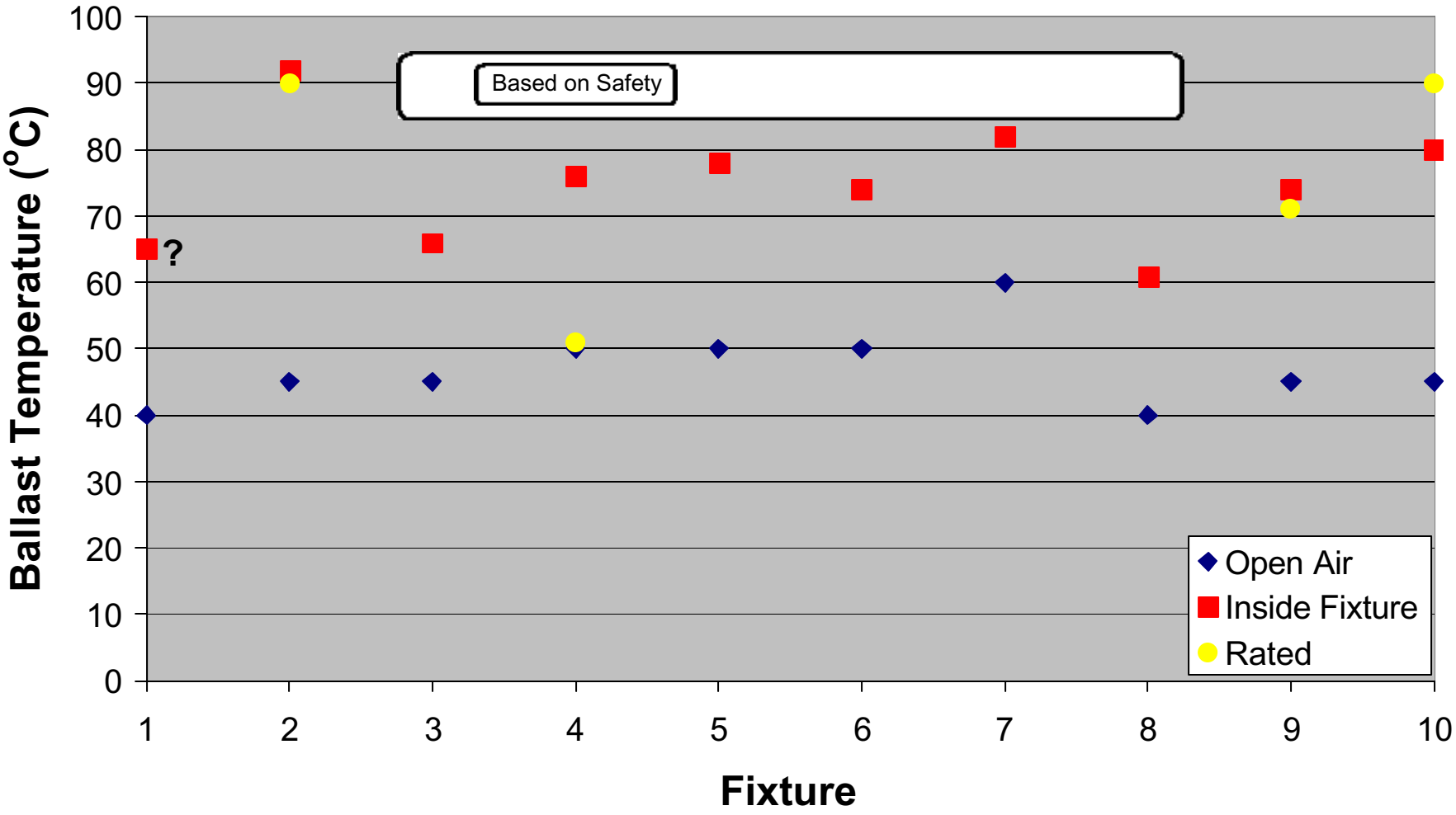
Thermal Test

Ceiling Mounted Fixtures with Electronic Ballasts



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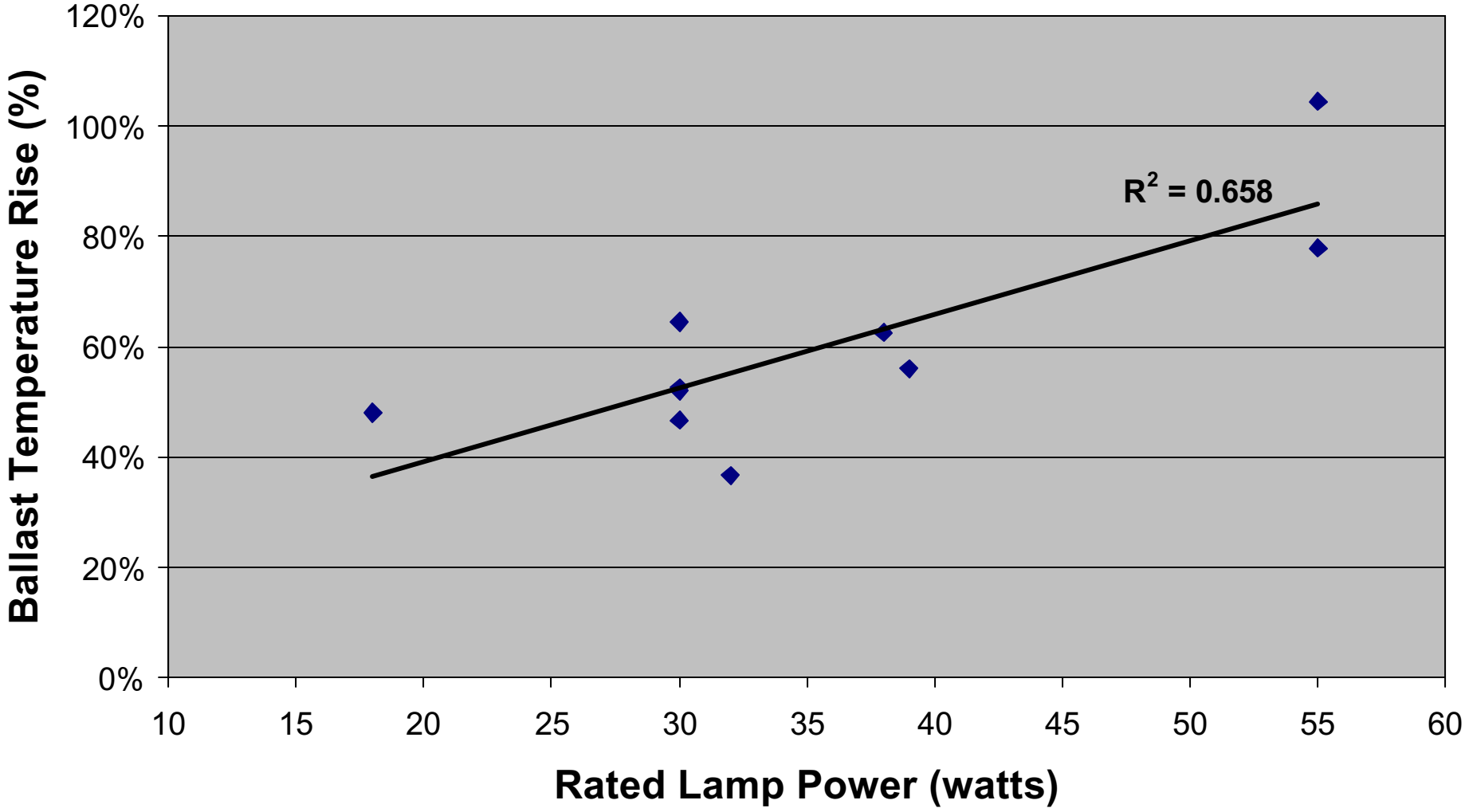
Thermal Test

Ceiling Mounted Fixtures with Electronic Ballasts



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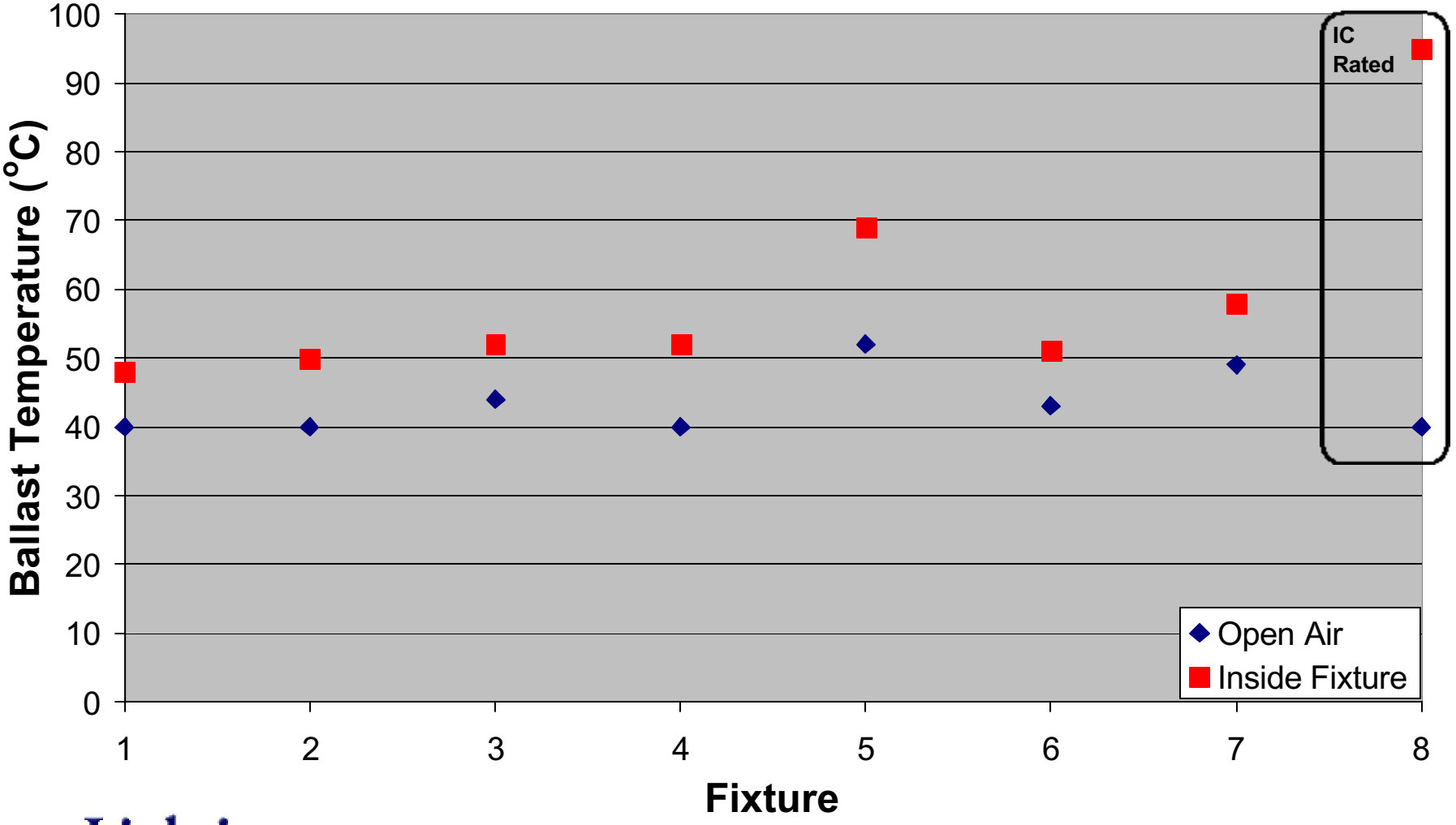
Thermal Test

Recessed Fixtures with Electronic Ballasts



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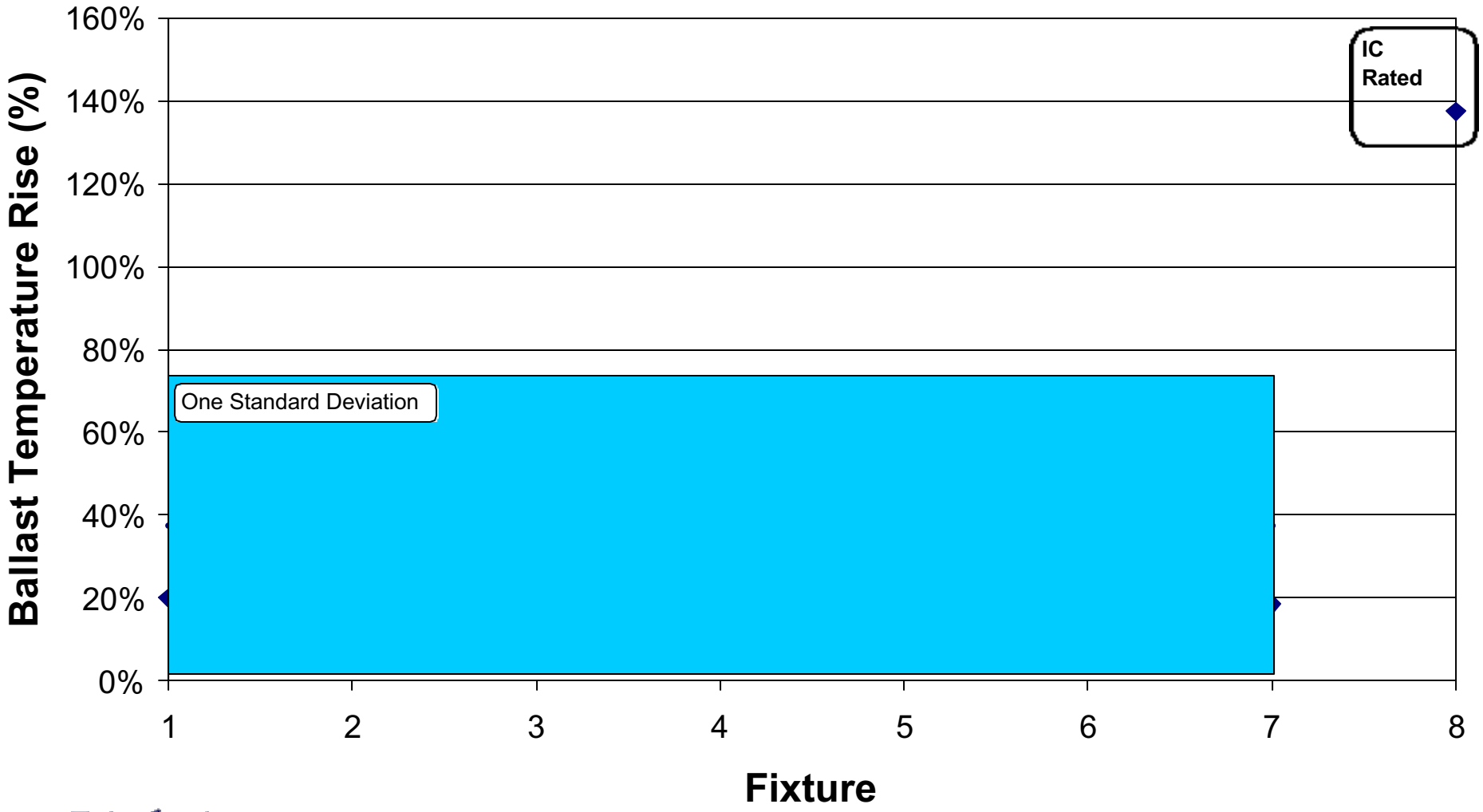
Thermal Test

Recessed Fixtures with Electronic Ballasts



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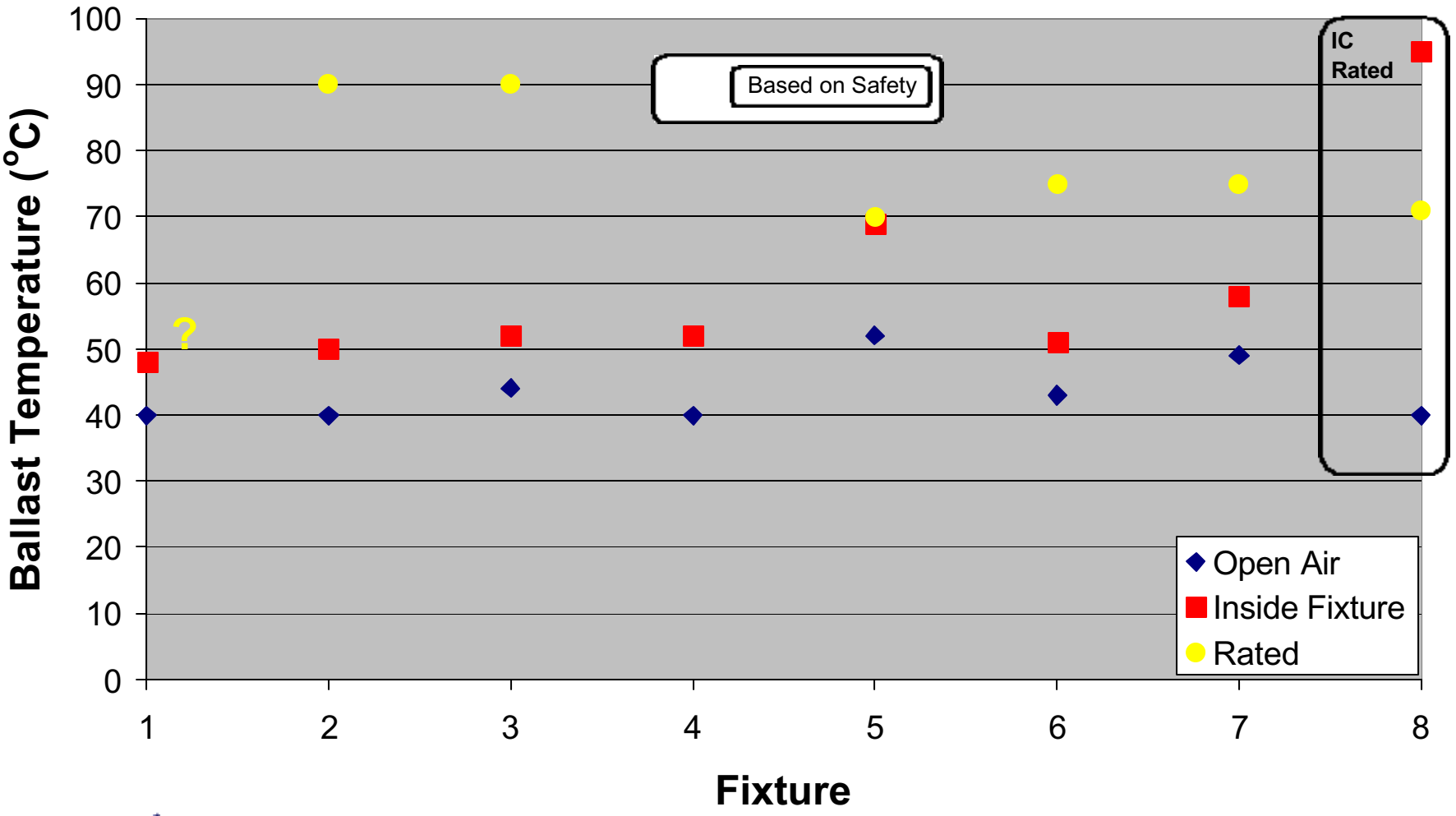
Thermal Test

Recessed Fixtures with Electronic Ballasts



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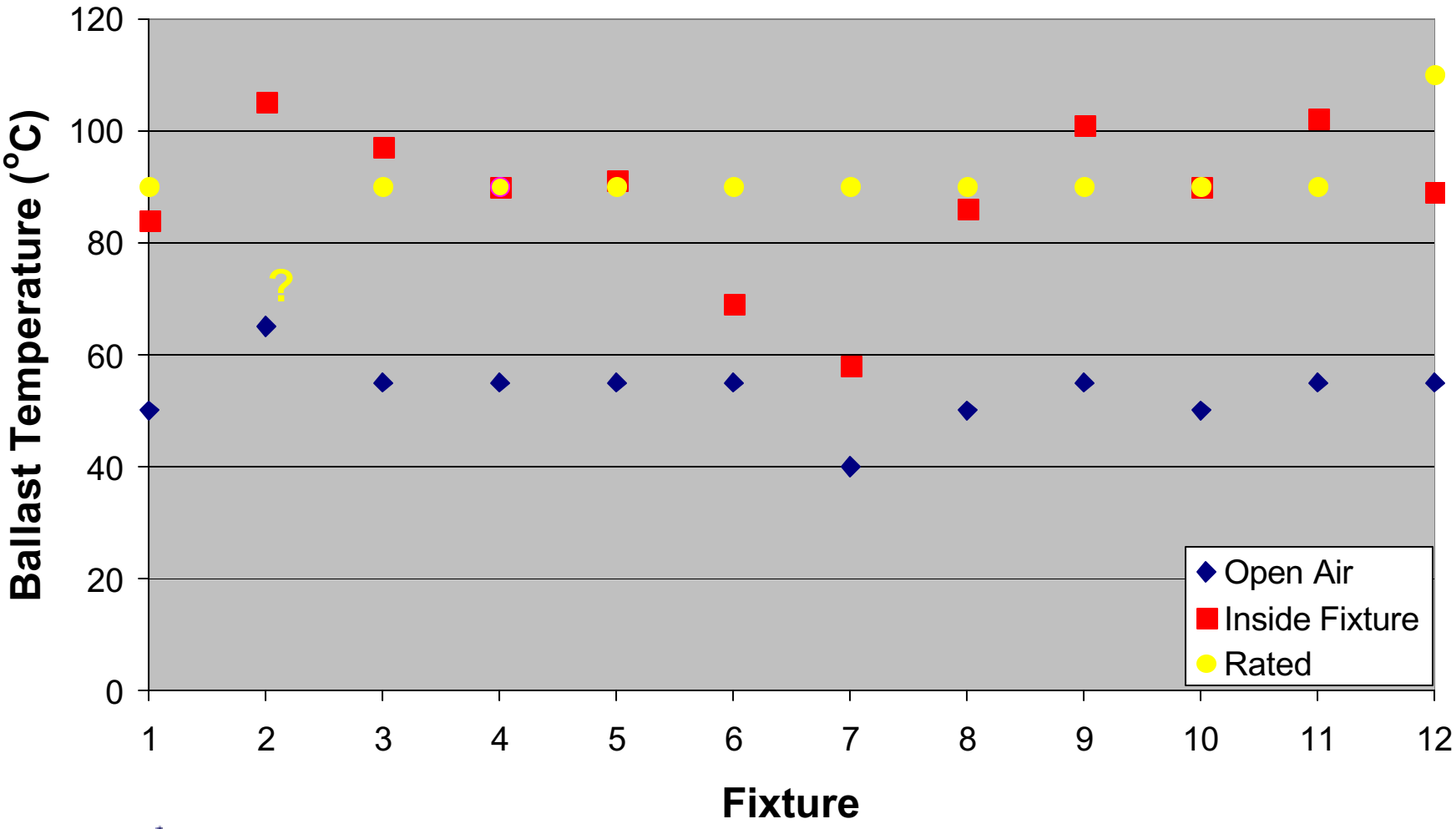
Thermal Test

Ceiling Fixtures with Magnetic Ballasts



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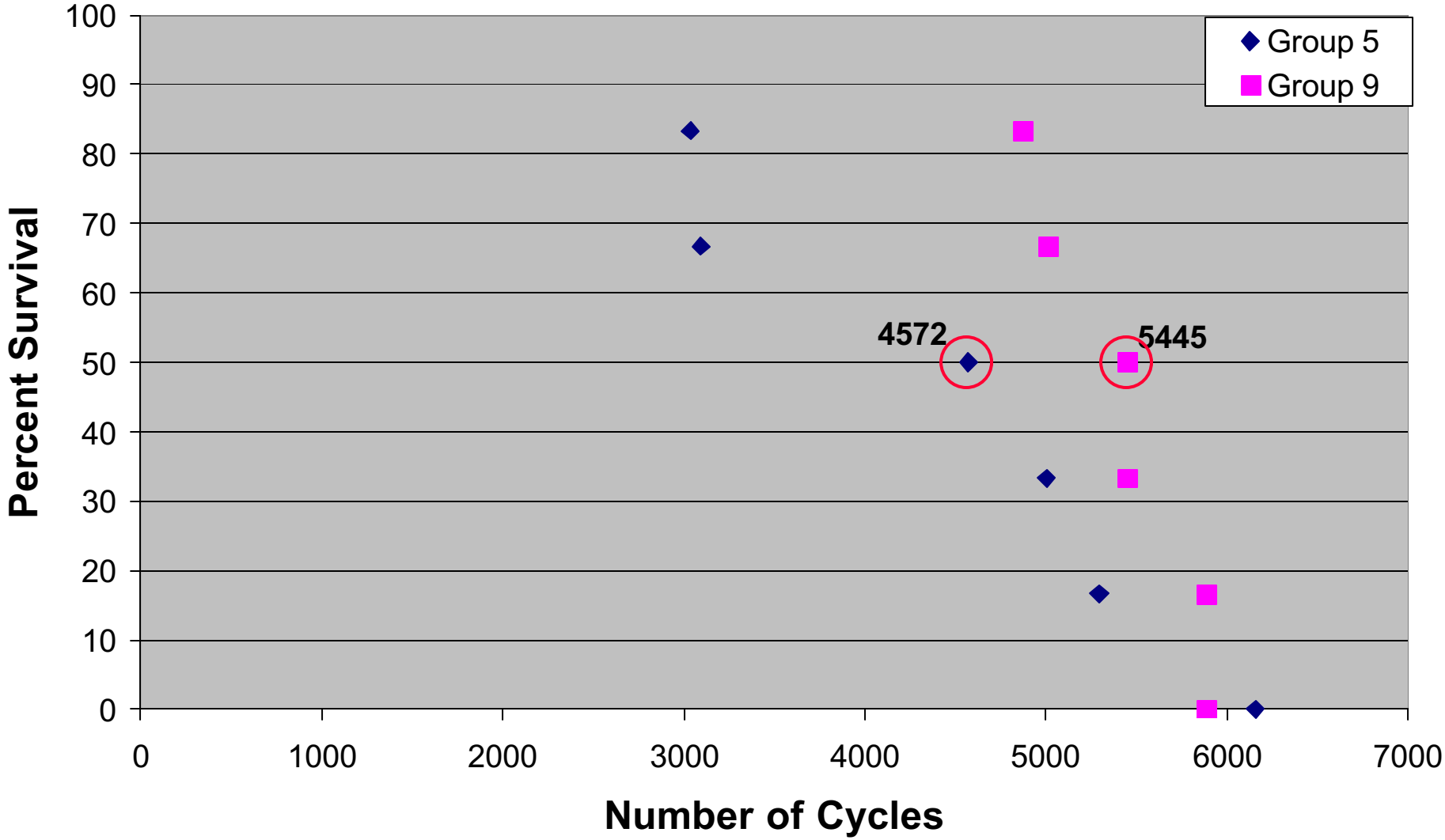
Rapid Cycle Stress Test

5 Min On/ 5 Min Off



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Questions?

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