WEBINARS BRIEF

Heating Cable – Testing Procedures
September 1, 2010

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PRECISION HEAT AND CONTROL

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Agenda

- System Overview
- System Start-up
- Mechanical Checks
- Electrical Tests
- Documentation
- Maintenance

- Testing
  - Megger Test
  - Cold Resistance Test
  - Stabilized Current Test
  - End of Circuit Voltage Test

- For Each Test
  - What is it
  - Why do it
  - When to do it
  - How to do it

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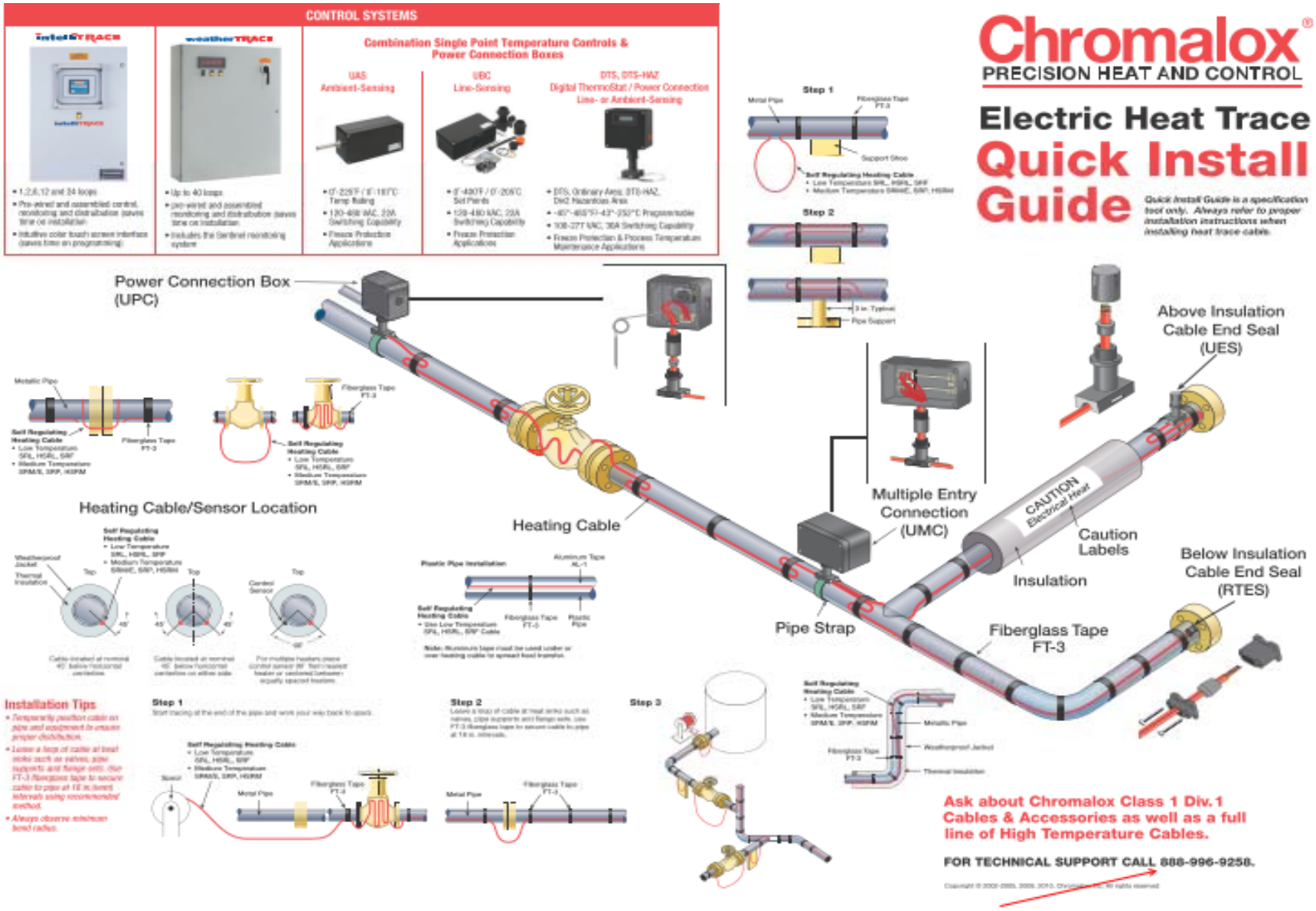
Overview



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System Start-up

- General Considerations
  - All parties involved should have a representative present for start-up.
  - All start-up info should be logged and signed off by appropriate parties.
  - All test equipment used for start-up testing should be in good repair and CALIBRATED!
  - Have all appropriate drawings, specifications, and instruction sheets on-hand for reference.
- Mechanical Inspection
  - Inspect all insulation and weatherproofing. (Wet insulation is Bad!)
  - Inspect all junction box, connection box and sensor connections
  - Verify sensors are in appropriate locations
  - Verify all circuits have been properly grounded
  - Verify all circuits are connected in proper panel locations
  - Verify proper circuit breakers are in place
  - Verify all circuit lengths are within manufacturers specified limits
  - Verify all proper safety warnings are in place
  - Verify all end seal, splice/tee locations are marked on lagging

System Start-up

- Electrical Tests
  - Insulation Resistance (Megger)
    - Before tracing pipes
    - After installing terminations
    - Before Insulating pipes
    - After Insulating pipes
    - Before Energizing System
  - Circuit Voltage
  - Initial Current
    - Note ambient temp and pipe temp
  - Stabilized Current (15 minutes of operation)
    - Note ambient temp and pipe temp

Model: AMB-5KV-D
5000V Insulation Tester

AM-150 TRMS
Digital Multimeter

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Documentation

Heat Trace Installation Inspection Record

Inspection Date: _____ Signature: _____

Title of Inspector: _____ Inspected By: _____

INSTALLATION AND MAINTENANCE LOG

Reference Information							
Circuit Number							
Circuit Breaker Number							
Drawing Number							
Circuit Length							
Heat Tracing Visual Checks							
No Signs of Moisture, Corrosion or Damage	Initial						
	Date						
Proper Electrical Connection	Initial						
	Date						
Proper Grounding of the Braid	Initial						
	Date						
Heat Tracing Electrical Checks							
Megger Test (Bypass Controls) (2500VDC)	Meg Ohms						
	Date						
Amperage Draw Test Compare to design Amperage Draw	Amperage						
	Amb. Temp.						
	Date						
Voltage at end of Circuit*	Voltage						
	Date						
Accessories/Control Checks							
Temperature Control Properly Set	Set Point						
	Date						
Sensors Protected and Undamaged	Initial						
	Date						
All Enclosures and Kits Closed and Sealed	Initial						
	Date						
Thermal Insulation Checks							
Location of Kits Visible on Outside of Insulation	Initial						
	Date						
Insulation is Complete, Dry and Weatherproof	Initial						
	Date						

*** This test must be performed at installation or at any time the cable is cut or damaged in any way.**

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Megger Test

- What is it???
  - Tests Insulation Resistance Between Conductive Core and Grounding Braid
  - Detects damage that can result in cable short to ground
    - Failure could trip circuit breaker or cause fire
- When to do??
  - Performed at the factory
  - After receipt at job site
  - After cable install
  - After Insulation
  - At Start-up
  - Periodically per maintenance procedure
- Equipment
  - Insulation Resistance Tester
    - Megger
  - 1000VDC Minimum
  - 2500VDC Best
  - Digital or Analog OK
  - Battery Operated Best
- How to do it
  - Disconnect cable from terminals in junction box
  - One lead to ground braid
  - One lead to buss wire
  - One minute
  - Must have 50 Meg Ohms Plus at 1000VDC
  - Record tested value

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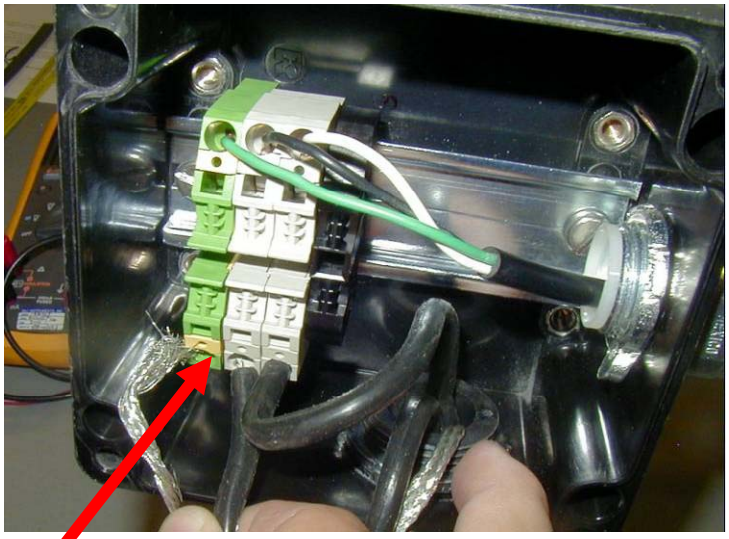
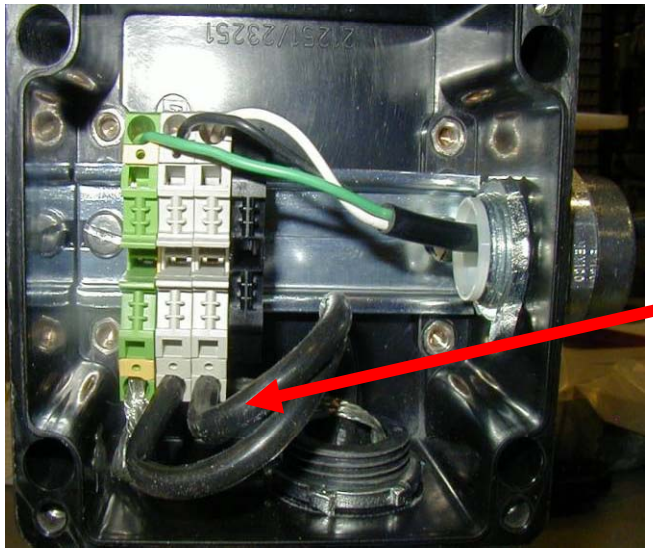
Megger Test





Remove braid and lead from terminal block

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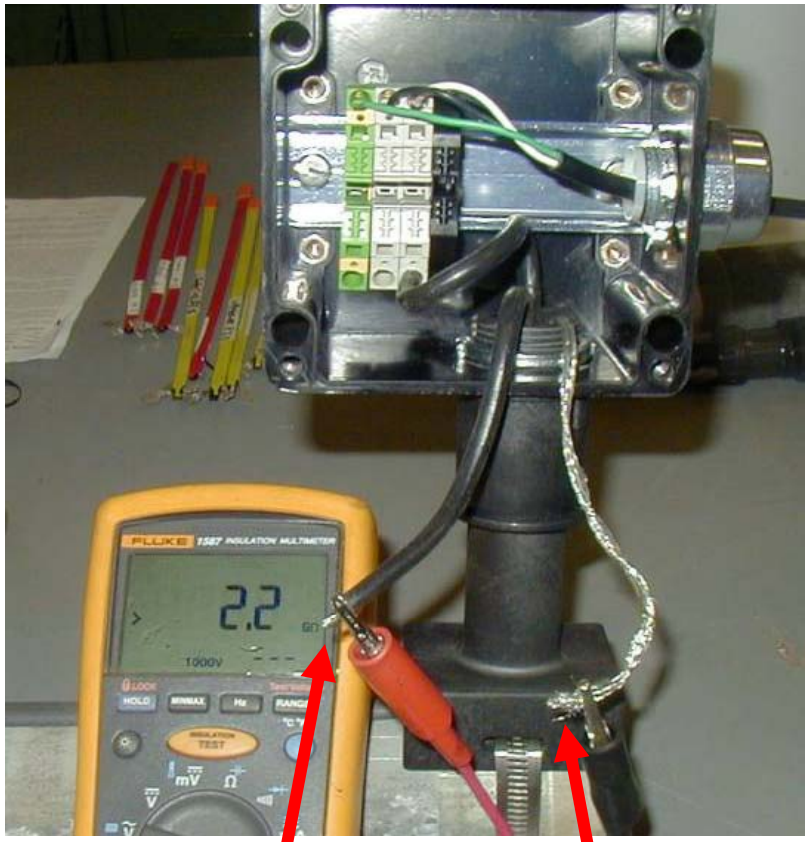
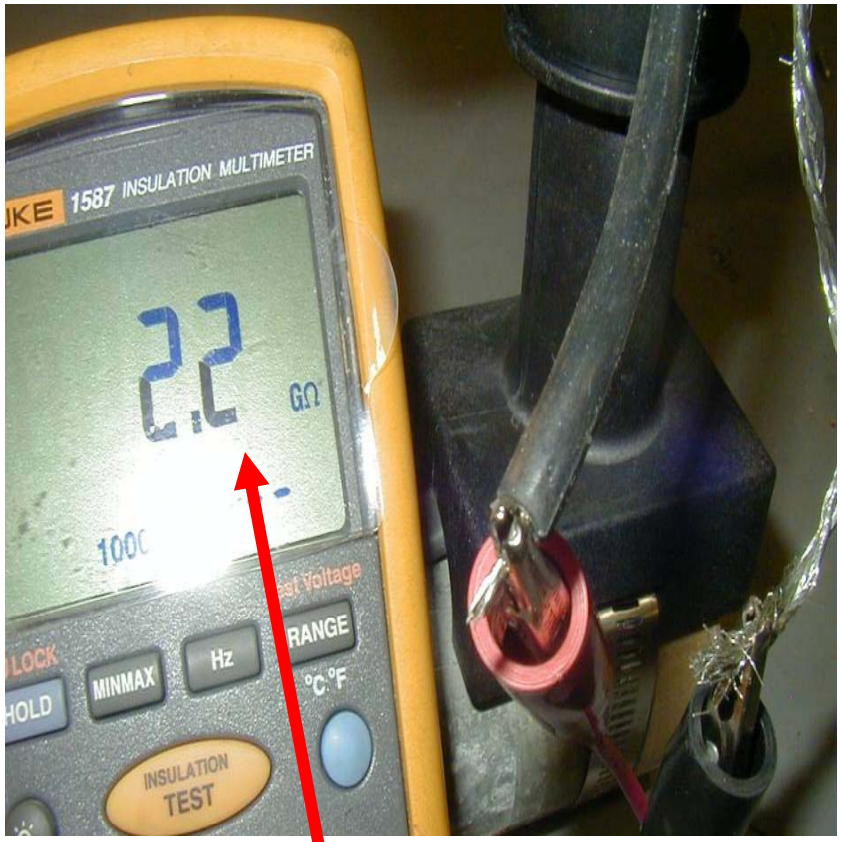
Megger Test



Test lead position



Result > 50Mohm

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Cold Resistance Test

- What is it???
  - Tests Resistance Between Cable Buss wires
  - Quick test to verify cable output
- When to do??
  - Performed at the factory
  - After receipt at job site
  - Prior to installation
- Equipment
  - Standard Multi Meter
  - Auto Range to 50Kohm
  - Digital or Analog OK
  - Battery Operated Best
- How to do it
  - Take one foot sample
  - Condition for one hour at 70 Deg F +/- 2 deg F
  - One lead to each buss wire
  - Set on Ohms
  - Compare to known values
  - Record

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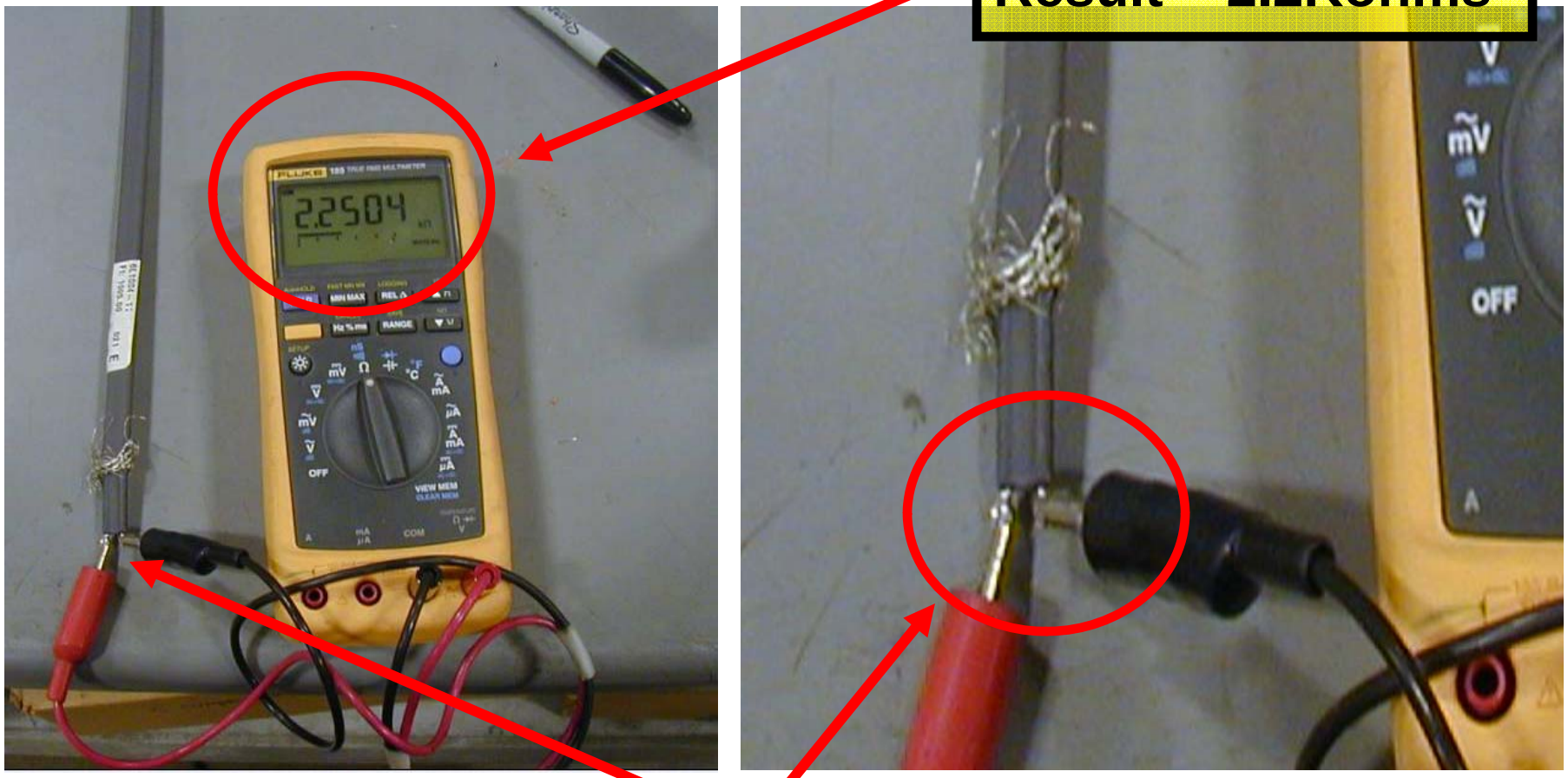
Cold Resistance Test



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Stabilized Current Test

- What is it???
  - Tests cable current at full voltage
  - Insures cable power output is correct for design and stable
- When to do It??
  - After Insulation
  - At Start-up
  - Periodically per maintenance procedure

Watts = Current * Voltage

- Equipment
  - Standard Multi Meter with clamp on current attachement
  - Auto Range to 100 amps
  - Digital or Analog OK
  - Battery Operated Best Insulation
- How to do it
  - Open UPC box
  - Clamp onto one buss wire
  - Energize circuit
  - Allow circuit to run for 20 minutes minimum
  - Take current reading / record
  - Divide by circuit length
  - Multiply by Voltage
  - Compare to output at pipe temp

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Stabilized Current Test

Open Cover

Clamp on buss wire

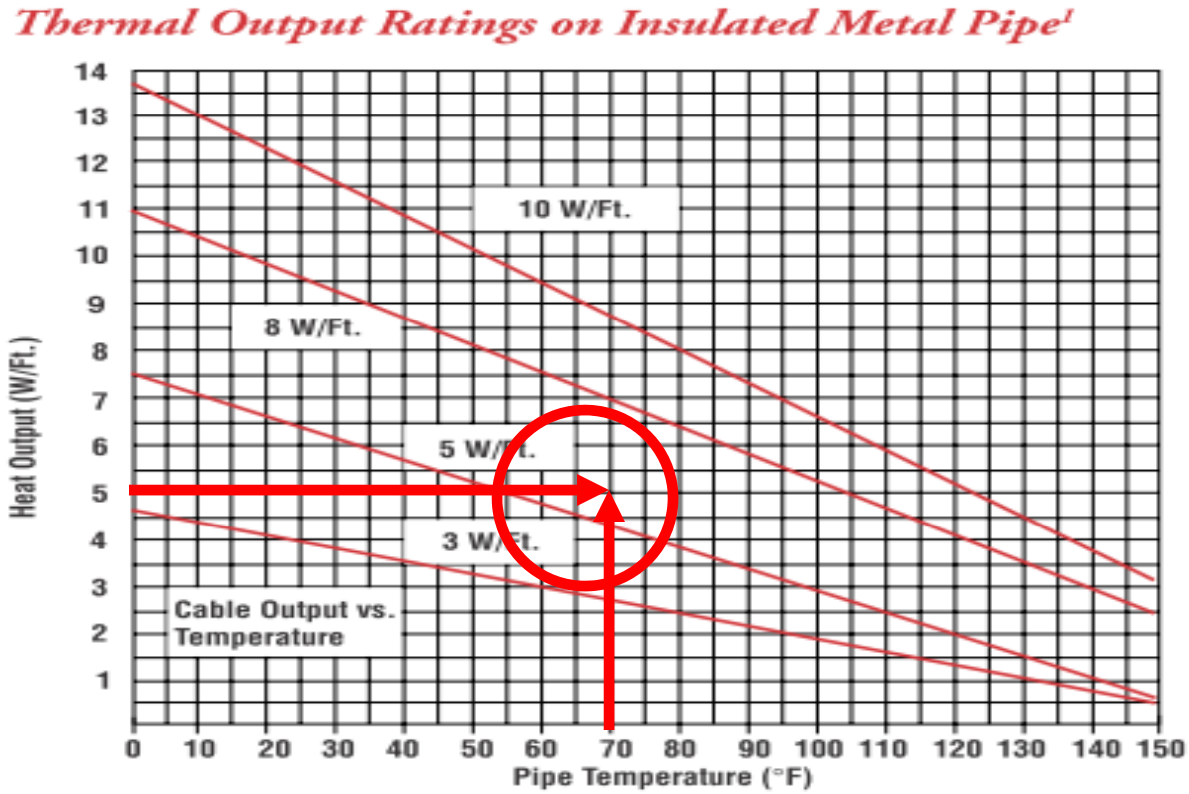
Read Result

Watts = Current * Voltage

Stabilized Current Test

Watts = Current * Voltage

Compare calculated result to output chart at temp



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End of Circuit Voltage Test

- What is it???
  - Tests Voltage at end of Line
  - Verifies proper Voltage Applied
  - Verifies Buss wires are good over entire length of cable
- When to do??
  - At start-up
  - Periodically per maintenance procedure
- Equipment
  - Standard Multi Meter
  - Auto Range to 600 Volts
  - Digital or Analog OK
  - Battery Operated Best
- How to do it
  - De-energize circuit
  - Remove end cap
  - Expose buss wires
  - One test lead to each buss wire
  - Energize circuit
  - Read voltage
  - Compare to desired value
  - Record

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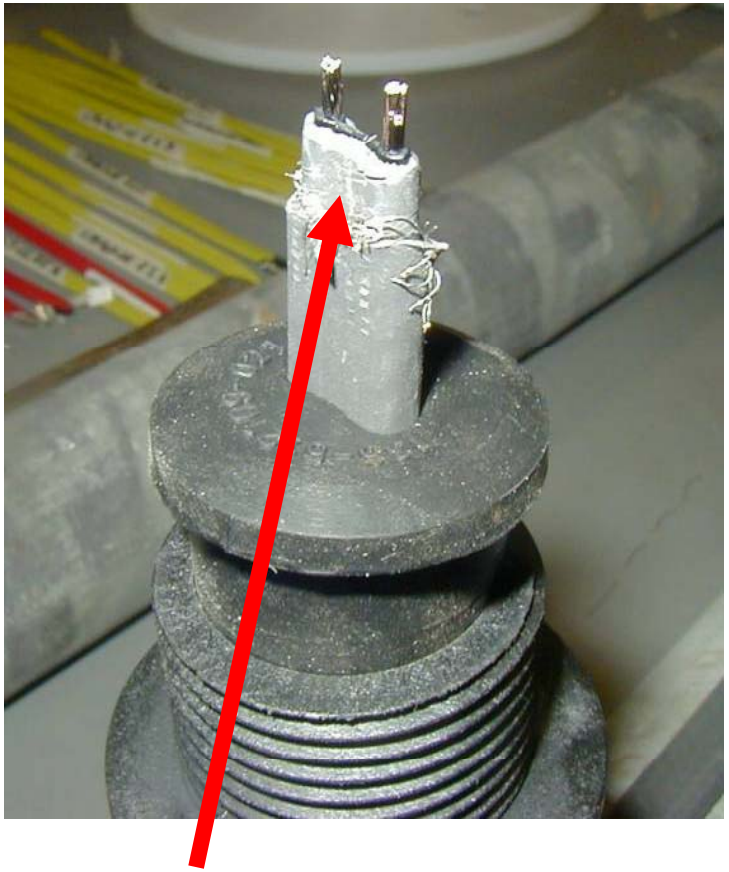
End of Circuit Voltage Test

Remove Cap



Expose Buss Wires

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End of Circuit Voltage Test

Test lead position

Result = 120Vac

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Maintenance

- General Considerations
  - All personnel should be qualified and trained to perform maintenance work.
  - All test equipment used should be in good repair and calibrated.
  - All inspection and test results should be documented on circuit maintenance log.
  - Freeze Protection should be checked prior to cold weather each year as a minimum.
  - Process Lines should be checked as the process requires.
- Mechanical Inspections
  - Follow same procedure as system start-up
- Electrical Inspections
  - Follow same procedure as system start-up