



Unless otherwise noted on the Manufacturing order, Drawing, and/or Heater Specification, the following electrical tests must be performed on all heaters except specific product line and/or designs.

Department Inspection: 100% department test required on all heaters.

- 1) Test all Non-UL / CSA Heaters per chart 1 (Non-UL / CSA Rated Heaters)
- 2) Test all UL / CSA heaters per chart 1 (Non-UL / CSA Rated Heaters)
- 3) If customer requires test data and heaters are UL / CSA rated, then test heaters per Chart 2 / Chart 3 or Chart 4

QC Inspection: Sample level

- 1) Test all Non-UL / CSA Heaters per chart 1 (Non-UL / CSA Rated Heaters)
- 2) Test all UL / CSA heaters per chart 2 (UL / CSA Rated Heaters) – Higher Voltage – 1 Second
- 3) If heater fails per Chart 1 & Chart 2 then test it according to Chart 3 (UL-1030 Rated Heaters) or Chart 4 (UL-499 / CSA STD 22.2 Rated Heaters) – Lower Voltage – 60 Seconds.

Non-UL / CSA Rated Heaters: Chart 1

Test Method	Test Requirement		Standard Test Limits	Frequency	Test Length
	$R_v = 0-250V$	$R_v = 251-600V$			
Hipot	1200V	1500V	5mA Max ³	60 Hz	1 Second Min
Insulation Resistance ¹	500V		500 MΩ Min	DC	1 Second Min
Element Continuity	Per Spec.		Per Spec.	N/A	1 Second Min
Ground Continuity ²	2Ω Max		N/A	N/A	1 Second Min

R_v = Heater Rated Voltage

Example Rated Voltage Hipot Test - Non UL / CSA Heater				
Heater Voltage	Test Requirement	STD Test Limits	Frequency	Test Length
110, 120	1200V	5mA Max ³	60 Hz	1 Second Min
208	1200V	5mA Max ³	60 Hz	1 Second Min
240	1200V	5mA Max ³	60 Hz	1 Second Min
277	1500V	5mA Max ³	60 Hz	1 Second Min
380	1500V	5mA Max ³	60 Hz	1 Second Min
460	1500V	5mA Max ³	60 Hz	1 Second Min
480	1500V	5mA Max ³	60 Hz	1 Second Min
575	1500V	5mA Max ³	60 Hz	1 Second Min
600	1500V	5mA Max ³	60 Hz	1 Second Min

¹ Test only required when the following are used to seal element ends:

Type R:	SEA-102-101	Type V1:	SEA-103-103/104
Type R1:	SEA-102-102	Type V4:	SEA-103-118/119
Type V:	SEA-103-117	Poly Resin	SEA-109-101/102
Type H:	Hermetic Seal	Type M:	Heat Shrink Boot

² Test only required when heater is supplied with a grounded molded plug set.

³ Up to 30mA acceptable w/long elements or wired in series.

Approval from Authorized personnel Required.

⁴ Per UL 1030 (Table 15.1), Method 2 -60sec (unheated cond.), Method 3- 1 sec. (De-energized cond.)

Per UL 499 (Table 50.1 Condition A and Condition B)



Unless otherwise noted on the Manufacturing order, Drawing, and/or Heater Specification, the following electrical tests must be performed on all heaters.

UL / CSA Rated Heaters: Chart 2 (UL-1030; UL-499 / CSA STD C22.2)

Test Method	Test Requirement		Standard Test Limits	Frequency	Test Length
	$R_v = 0-250V$	$R_v = 251-600V$			
Hipot ⁴	1200V	$1200V+(2.4 \cdot R_v)$	5mA Max ³	60 Hz	1 Second Min
Insulation Resistance ¹	500V		500 MΩ Min	DC	1 Second Min
Element Continuity	Per Spec.		Per Spec.	N/A	1 Second Min
Ground Continuity ²	2Ω Max		N/A	N/A	1 Second Min

R_v = Heater Rated Voltage

Example Rated Voltage Hipot Test - Method 1: UL / CSA Heater				
Heater Voltage	Test Requirement	STD Test Limits	Frequency	Test Length
110, 120	1200V	5mA Max ³	60 Hz	1 Second Min
208	1200V	5mA Max ³	60 Hz	1 Second Min
240	1200V	5mA Max ³	60 Hz	1 Second Min
277	1865V	5mA Max ³	60 Hz	1 Second Min
380	2112V	5mA Max ³	60 Hz	1 Second Min
400	2160V	5mA Max ³	60 Hz	1 Second Min
415	2196V	5mA Max ³	60 Hz	1 Second Min
440	2256V	5mA Max ³	60 Hz	1 Second Min
460	2304V	5mA Max ³	60 Hz	1 Second Min
480	2352V	5mA Max ³	60 Hz	1 Second Min
575	2580V	5mA Max ³	60 Hz	1 Second Min
600	2640V	5mA Max ³	60 Hz	1 Second Min

¹ Test only required when the following are used to seal element ends:

Type R:	SEA-102-101	Type V1:	SEA-103-103/104
Type R1:	SEA-102-102	Type V4:	SEA-103-118/119
Type V:	SEA-103-117	Poly Resin	SEA-109-101/102
Type H:	Hermetic Seal	Type M:	Heat Shrink Boot

² Test only required when heater is supplied with a grounded molded plug set.

³ Up to 30mA acceptable w/long elements or wired in series.

Approval from Authorized personnel Required.

⁴ Per UL 1030 (Table 15.1), Method 2 -60sec (unheated cond.), Method 3- 1 sec. (De-energized cond.)

Per UL 499 (Table 50.1 Condition A and Condition B)



Unless otherwise noted on the Manufacturing order, Drawing, and/or Heater Specification, the following electrical tests must be performed on all heaters.

UL Rated Heaters: Chart 3 (UL-1030)

Test Method	Test Requirement		Standard Test Limits	Frequency	Test Length
	$R_v = 0-250V$	$R_v = 251-600V$			
Hipot ⁴	1000V	1200V	5mA Max ³	60 Hz	60 Seconds Min
Insulation Resistance ¹	500V		500 MΩ Min	DC	1 Second Min
Element Continuity	Per Spec.		Per Spec.	N/A	1 Second Min
Ground Continuity ²	2Ω Max		N/A	N/A	1 Second Min

R_v = Heater Rated Voltage

Example Rated Voltage Hipot Test - Method 1: UL Heater

Heater Voltage	Test Requirement	STD Test Limits	Frequency	Test Length
110, 120	1000V	5mA Max ³	60 Hz	60 Seconds Min
208	1000V	5mA Max ³	60 Hz	60 Seconds Min
240	1000V	5mA Max ³	60 Hz	60 Seconds Min
277	1200V	5mA Max ³	60 Hz	60 Seconds Min
380	1200V	5mA Max ³	60 Hz	60 Seconds Min
400	1200V	5mA Max ³	60 Hz	60 Seconds Min
415	1200V	5mA Max ³	60 Hz	60 Seconds Min
440	1200V	5mA Max ³	60 Hz	60 Seconds Min
460	1200V	5mA Max ³	60 Hz	60 Seconds Min
480	1200V	5mA Max ³	60 Hz	60 Seconds Min
575	1200V	5mA Max ³	60 Hz	60 Seconds Min
600	1200V	5mA Max ³	60 Hz	60 Seconds Min

¹ Test only required when the following are used to seal element ends:

Type R:	SEA-102-101	Type V1:	SEA-103-103/104
Type R1:	SEA-102-102	Type V4:	SEA-103-118/119
Type V:	SEA-103-117	Poly Resin	SEA-109-101/102
Type H:	Hermetic Seal	Type M:	Heat Shrink Boot

² Test only required when heater is supplied with a grounded molded plug set.

³ Up to 30mA acceptable w/long elements or wired in series.

Approval from Authorized personnel Required.

⁴ Per UL 1030 (Table 15.1), Method 2 -60sec (unheated cond.), Method 3- 1 sec. (De-energized cond.)

Per UL 499 (Table 50.1 Condition A and Condition B)



Unless otherwise noted on the Manufacturing order, Drawing, and/or Heater Specification, the following electrical tests must be performed on all heaters.

UL / CSA Rated Heaters: Chart 4 (UL-499 / CSA STD C22.2)

Test Method	Test Requirement		Standard Test Limits	Frequency	Test Length
	$R_v = 0-250V$	$R_v = 251-600V$			
Hipot ⁴	1000V	$1000V + (2.0 * R_v)$	5mA Max ³	60 Hz	60 Seconds Min
Insulation Resistance ¹	500V		500 MΩ Min	DC	1 Second Min
Element Continuity	Per Spec.		Per Spec.	N/A	1 Second Min
Ground Continuity ²	2Ω Max		N/A	N/A	1 Second Min

R_v = Heater Rated Voltage

Example Rated Voltage Hipot Test - Method 1: UL Heater				
Heater Voltage	Test Requirement	STD Test Limits	Frequency	Test Length
110, 120	1000V	5mA Max ³	60 Hz	60 Seconds Min
208	1000V	5mA Max ³	60 Hz	60 Seconds Min
240	1000V	5mA Max ³	60 Hz	60 Seconds Min
277	1554V	5mA Max ³	60 Hz	60 Seconds Min
380	1760V	5mA Max ³	60 Hz	60 Seconds Min
400	1800V	5mA Max ³	60 Hz	60 Seconds Min
415	1830V	5mA Max ³	60 Hz	60 Seconds Min
440	1880V	5mA Max ³	60 Hz	60 Seconds Min
460	1920V	5mA Max ³	60 Hz	60 Seconds Min
480	1960V	5mA Max ³	60 Hz	60 Seconds Min
575	2150V	5mA Max ³	60 Hz	60 Seconds Min
600	2200V	5mA Max ³	60 Hz	60 Seconds Min

¹ Test only required when the following are used to seal element ends:

Type R:	SEA-102-101	Type V1:	SEA-103-103/104
Type R1:	SEA-102-102	Type V4:	SEA-103-118/119
Type V:	SEA-103-117	Poly Resin	SEA-109-101/102
Type H:	Hermetic Seal	Type M:	Heat Shrink Boot

² Test only required when heater is supplied with a grounded molded plug set.

³ Up to 30mA acceptable w/long elements or wired in series.

Approval from Authorized personnel Required.

⁴ Per UL 1030 (Table 15.1), Method 2 -60sec (unheated cond.), Method 3- 1 sec. (De-energized cond.)

Per UL 499 (Table 50.1 Condition A and Condition B)