Stable Laser Systems

VH-6020-4

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Stable Laser Systems

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1 Proper Care Guidelines

1.1 High Vacuum

To ensure optimal performance, Latex or Nitrile gloves should always be worn when working with materials that will be placed inside the vacuum can, or when touching internal surfaces.

Be very careful with the vacuum surfaces. Aluminum is soft, and radial scratches in the area of the O-ring are detrimental to the sealing surface of the can. Please work on a soft surface covered in lint-free cleanroom wipes, and keep all tools and other hard materials well clear of the aluminum surfaces.

1.2 Evacuating

Pumping air out of the vacuum can, or re-admitting gas to the vacuum housing, should be done extremely slowly. Please plan to pump very slowly from atmospheric pressure to a pressure of a few Torr. This reduces the chance that particulates will be stirred up and deposited on the cavity mirrors. An in-line filter is recommended to slow the pumping speed. Stable Laser Systems recommends pumping out the vacuum chamber for a period of a few days to ensure optimal performance.

The vacuum chamber can be vented with very clean (oil-free) air or gas, such as nitrogen, and a small positive pressure can be maintained while the cavity is being loaded.

2 Loading the Vacuum Chamber

2.1 Disassembly

Place the vacuum housing in the location where it will permanently reside to avoid having to move the assembly with the cavity installed. It is recommended that the clamping forks provided are used to secure down the vacuum housing before loading the cavity. Unscrew the M3 x 6 button head screws and remove the front thermal shell endcap (the one nearest the Stable Laser Systems logo).

(a) Fully assembled VH-6010-4

(b) Remving M3 x 6 screws

Figure 1: Removing the front thermal shell endcap

Remove the loose thermal insulation. Be sure to also remove the annular ring of thermal insulation around the can. Leave the black plastic insulation stop in place to keep the insulation around the tube from falling into the can while loading the cavity.

(a) Remove the circular insulation

(b) Leave the insulation stop in place

Figure 2: Removing the thermal insulation

Disconnect the front heater by unplugging the white connector that attaches the flange heater to the body. Unscrew and remove the vacuum chamber flange, taking particular care to hold the flange while the last screw is removed so it doesn't scratch the sealing surface while moving against the can. Place the flange O-ring side up on a clean cleanroom wipe, taking care not to damage the window.

(a) Disconnect the heater

(b) Place the window side down on a clean surface

Figure 3: Removing the front vacuum flange

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2.2 Loading the cavity

Generally, the mirrors should have an engraving on the edge to indicate the radius of curvature. If no radius is indicated, the mirror with the larger coating will be the concave mirror, and the smaller coating will be the plano mirror. Take note of the cavity orientation before loading it into the housing.

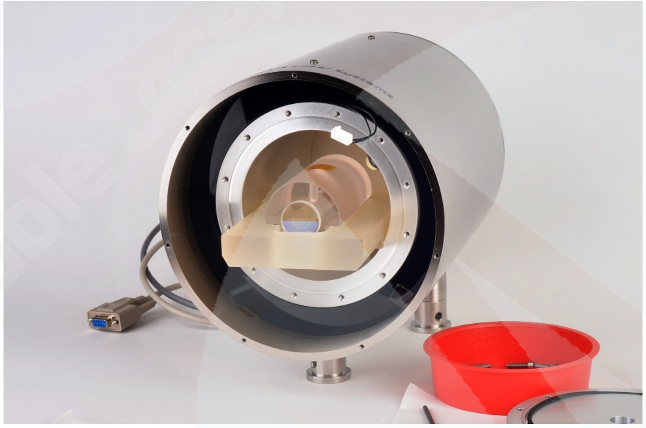
Load the cavity onto the Zerodur mounting block, using the Viton balls provided. Place the four 1/4" Viton balls in the machined holes in the mounting block. A white delrin alignment fixture has been provided with the mounting block. Place the alignment fixture over one end of the cavity support. Center the cavity in the cutout and lower it into the support while firmly holding the alignment fixture. Remove the alignment fixture and the Kapton tape covering the vent hole prior to loading the cavity.

(a) Insert the Viton balls into the machined holes

(b) Gently place the cavity in the mounting block, using the alignment fixture to ensure proper positioning

Figure 4: Cavity mounting block assembly

Load the Zerodur mounting block into the can by sliding the block into the grooves in the chamber. Try to align the block so that there is an equal gap on each side with respect to the vacuum chamber.



(a) Place the mounting block on the grooves

(b) Slide the mounting block into position

Figure 5: Loading the cavity and mounting block

2.3 Reassembly

Replace the vacuum end flange, and fasten the screws in a diametric pattern. Following the points of a clock, first insert a screw at 12 o'clock, then 6 o'clock, 3 o'clock, then 9 o'clock, and repeat this diametric pattern for the two other sets of four screws. Repeat the pattern, graduating in torque each pass from finger-tight the first pass, 10 in · lbs (1.13 Nm) on the second pass, 20 in · lbs (2.25 Nm) on the third pass, and then 2-3 additional passes at 30 in · lbs (3.39 Nm). Do not exceed 36 in · lbs (4 Nm) or damage may occur to the flange.

Reconnect the heater and replace the thermal insulation. Then reattach the thermal shell end cap.

3 Connecting to a Temperature Controller

3.1 Integrated heaters

The integrated heater resistance is close to 5.5 Ohms at room temperature.

The thermistors are General Electric MC65F103B, and a data sheet may be found in Appendix 1. Please consider the self-heating of the thermistor when measuring absolute temperature.

3.2 DB-9 Pinout

The pinout for the vacuum housing 9 pin D-sub cable is as follows. The additional cable is connected to a test thermistor which may be monitored on a multimeter.

Pin Number	Description
1	Heater
2	Heater
4	Thermistor
5	Thermistor
Others	N/C

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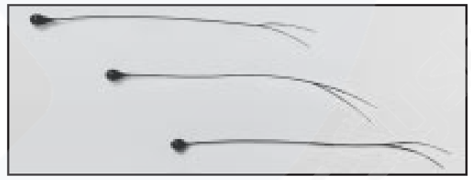
4 Appendix 1 - GE MC65F103B Thermistor

NTC THERMISTORS: TYPE MC65

INSULATED LEAD INTERCHANGEABLE CHIP THERMISTOR

DESCRIPTION:

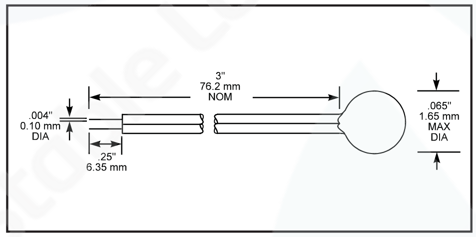
Epoxy Coated interchangeable chip thermistors with heavy isomid insulated Nickel lead-wires.



FEATURES:

- Precision, solid state temperature sensor
- Interchangeability down to ±0.05 °C
- Suitable for use over the range of –40°C to +105°C
- High sensitivity greater than –4%/°C at 25°C
- Suitable for temperature measurement, control and compensation
- High reliability and stability over interchangeable range
- Special tight tolerances in the clinical range for Medical applications
- Most popular R-vs-T curves are available
- Fully insulated
- Resin coated for good mechanical strength and resistance to solvents
- .004" (.1 mm) dia. heavy isomid insulated Bifilar Nickel lead-wires

DIMENSIONS:



Select appropriate part number below for resistance and temperature tolerance desired

$R_{25°C}$	MATERIAL SYSTEM	± .05°C; 35°C to 39°C ± .075°C; 39°C to 42°C ± .10°C; 20°C to 45°C ± .15°C; 0°C to 50°C	± .1°C; 35°C to 39°C ± .15°C; 20°C to 45°C ± .2°C; 0°C to 50°C	± .15°C; 35°C to 39°C ± .2°C; 20°C to 45°C ± .25°C; 0°C to 50°C
2252	F	MC65F232A	MC65F232B	MC65F232C
3000	F	MC65F302A	MC65F302B	MC65F302C
5000	F	MC65F502A	MC65F502B	MC65F502C
10000	F	MC65F103A	MC65F103B	MC65F103C
10000	Y	MC65Y103A	MC65Y103B	MC65Y103C
30000	H	MC65H303A	MC65H303B	MC65H303C
50000	G	MC65G503A	MC65G503B	MC65G503C
100000	Y	MC65Y104A	MC65Y104B	MC65Y104C
100000	G	MC65G104A	MC65G104B	MC65G104C

OPTIONS:

Consult factory for availability of options:

- Other resistance values in the range of 100Ω - 100kΩ
- Other tolerances or ranges
- Other lead wires or lengths
- Non standard R-vs-T curves
- Controlled dimensions

DATA:

THERMAL AND ELECTRICAL PROPERTIES:

Dissipation constant:........(still air) .5 mW/°C
(stirred oil) 4 mW/°C

Thermal time constant:.....(still air) 8 sec.
(stirred oil) .5 sec.

Maximum power at 25°C 25mW
(derated from 100% at 25°C to 0% at 100°C)

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MATERIAL TYPE: F

AVAILABLE PRODUCTS:

HM, C100, EC95, DC95, MC65, MF65, SC30, SC50

Data for material type : F

Temp Range (°C)	Ratio	Beta
0 to 50	9.08	3895
0 to 70	18.64	3917
25 to 50	2.78	3933
25 to 85	9.30	3969
25 to 100	14.64	3981
25 to 125	29.05	3999
37.8 to 104.4	9.67	4000

To calculate Rt/R25 at temperatures other than those listed in the table, use the following equation:

$Rt/R25 = \exp\{A + B/_T + C/_T{}^2 + D_{/T}{}^3\}$

where T = temperature in K

where K = °C + 273.15

Temp Range (°C)	A	B	C	D
-50 to 0	-1.4122478E+01	4.4136033E+03	-2.9034189E+04	-9.3875035E+06
0 to 50	-1.4141963E+01	4.4307830E+03	-3.4078983E+04	-8.8941929E+06
50 to 100	-1.4202172E+01	4.4975256E+03	-5.8421357E+04	-5.9658796E+06
100 to 150	-1.6154078E+01	6.8483992E+03	-1.0004049E+06	1.1961431E+08

To calculate the actual thermistor temperature as a function of the thermistor resistance, use the following equation:

$l/T = a + b(\ln Rt/R25) + c(\ln Rt/R25)^2 + d(\ln Rt/R25)^3$

Rt/R25 range	a	b	c	d
68.600 to 3.274	3.3538646E-03	2.5654090E-04	1.9243889E-06	1.0969244E-07
3.274 to 0.36036	3.3540154E-03	2.5627725E-04	2.0829210E-06	7.3003206E-08
0.36036 to 0.06831	3.3539264E-03	2.5609446E-04	1.9621987E-06	4.6045930E-08
0.06831 to 0.01872	3.3368620E-03	2.4057263E-04	-2.6687093E-06	-4.0719355E-07

†The deviation resulting from the tolerance on the material constant, Beta. The deviation must be added to the resistance tolerance of the part as specified at 25°C.

Temperature (°C)	Rt/R25 nominal	Temp Coef ∝ (%/°C)	β Deviation† (±%)
-50	68.60	7.21%	2.30%
-45	48.16	6.96%	2.68%
-40	34.23	6.71%	2.87%
-35	24.62	6.48%	2.92%
-30	17.91	6.26%	2.86%
-25	13.17	6.05%	2.71%
-20	9.782	5.85%	2.50%
-15	7.339	5.66%	2.25%
-10	5.558	5.47%	1.97%
-5	4.247	5.30%	1.68%
0	3.274	5.13%	1.37%
5	2.544	4.97%	1.07%
10	1.992	4.81%	0.78%
15	1.572	4.67%	0.50%
20	1.250	4.53%	0.24%
25	1.000	4.39%	0.00%
30	0.8056	4.26%	0.21%
35	0.6530	4.14%	0.40%
40	0.5326	4.02%	0.56%
45	0.4369	3.91%	0.69%
50	0.3604	3.80%	0.80%
55	0.2989	3.69%	0.87%
60	0.2491	3.59%	0.92%
65	0.2087	3.49%	0.93%
70	0.1756	3.40%	0.92%
75	0.1485	3.31%	0.88%
80	0.1261	3.23%	0.81%
85	0.1075	3.14%	0.72%
90	0.09209	3.06%	0.59%
95	0.07916	2.99%	0.45%
100	0.06831	2.91%	0.28%
105	0.05916	2.85%	0.08%
110	0.05141	2.77%	0.12%
115	0.04483	2.70%	0.36%
120	0.03922	2.64%	0.61%
125	0.03442	2.57%	0.87%
130	0.03030	2.51%	1.16%
135	0.02675	2.47%	1.46%
140	0.02369	2.41%	1.82%
145	0.02103	2.35%	2.14%
150	0.01872	2.35%	2.46%

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