TECH NOTE

Temperature Stability of the LDT-53500

OVERVIEW

This technical note presents an overview of the temperature stability of the LDT-53500 Series Laser Diode Thermoelectric Chiller.

BACKGROUND

The LDT-53500 was designed for temperature control of laser diodes that are mounted on either an ILX Lightwave mount or other cold plate. Wavelength and optical power of laser diodes are sensitive to temperatures changes, and it is important for the chiller to provide high temperature stability. The LDT-53500 chiller's temperature controller provides bi-polar current to the thermoelectric modules (TEC) embedded in the liquid to air heat exchanger. The temperature controller uses a pulse-width modulated (PWM) output and proportional–integral–derivative (PID) control loop.

MEASUREMENT SETUP

Figure 1 shows a diagram of the stability measurement setup. The LDT-53500 is connected to a constant thermal load equal to approximately half the maximum chiller cooling capacity. For the LDT-53520 200W chiller the load used was 100W. For the LDT-53540 375W chiller the load used was 200W. A thermistor embedded in the thermal load provided temperature measurement of the thermal load while a second thermistor monitored ambient temperature. Both thermistors were connected to an Agilent 34970A Data Acquisition Switch Unit, which was connected to a PC through a GPIB cable. A data logging program was used to capture the temperature of the ambient thermistor and the load thermistor.

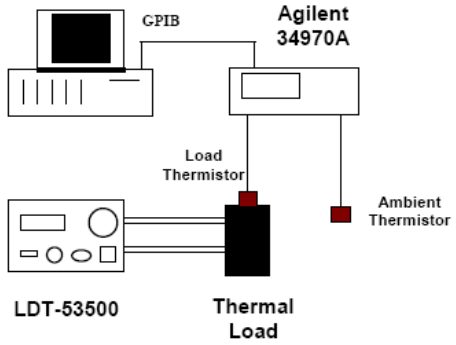

Figure 1: Measurement setup diagram

Three tests were performed on each chiller model. The first test was a one hour warm up test to determine approximately how long the LDT-53500 took to stabilize at the desired temperature. The second test was a 24 hour test using the internal thermistor as the feedback control to the thermistor. The final test was also a 24 hour test but used the external thermistor embedded in the thermal load as the feedback control thermistor. Both 24 hour tests allowed for at least a one hour warm up period.

RESULTS

The following graphs show load temperature and ambient temperature versus time. Ambient temperature was plotted on the second Y-axis due to the relatively large temperature changes when compared to the load temperature. The LDT-53500 stability specification is ±0.05°C. The upper and lower stability limits have also been plotted on the graph.

From the 1 hour warm up test (Figures 2 and 3) it can be seen that it takes the LDT-53500 chillers less than 10 minutes to reach the stability specification of ±0.05°C.

It can be seen from the 24 hour test results in Figures 4 through 7 that the LDT-53500 series maintained a stability of better than ±0.05°C for a period of 24 hours. Ambient temperature fluctuated ±1.0°C during the 24 hour test and can be observed as small fluctuations in load temperature.

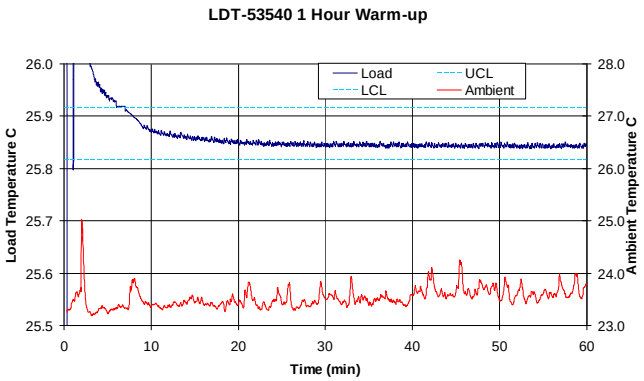

Figure 2

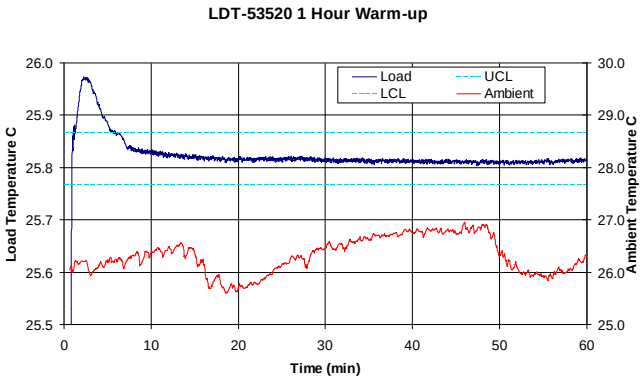

Figure 3

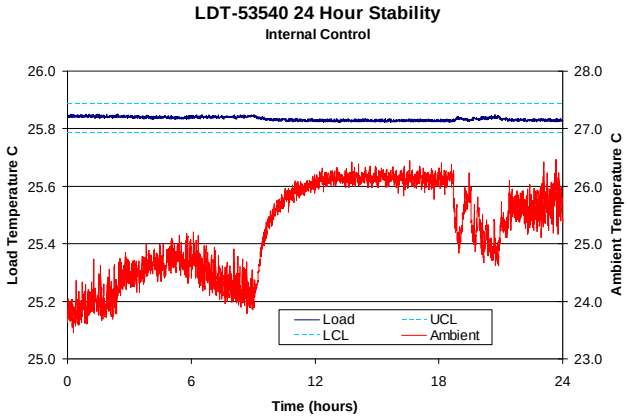

Figure 4

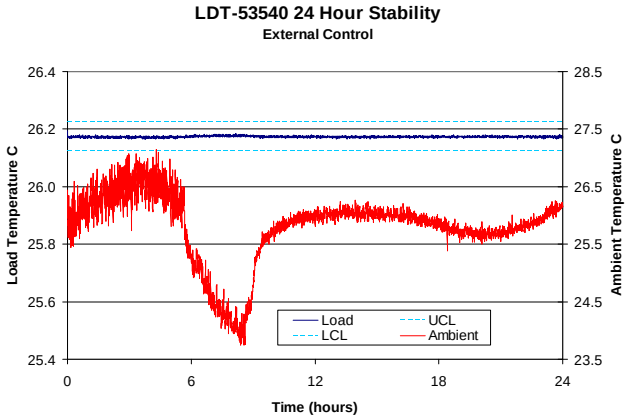

Figure 5

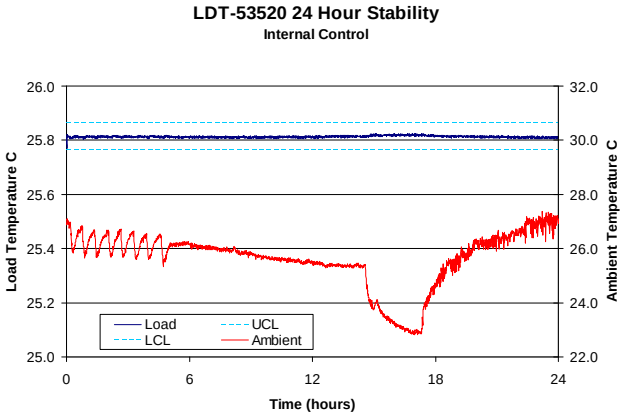

Figure 6

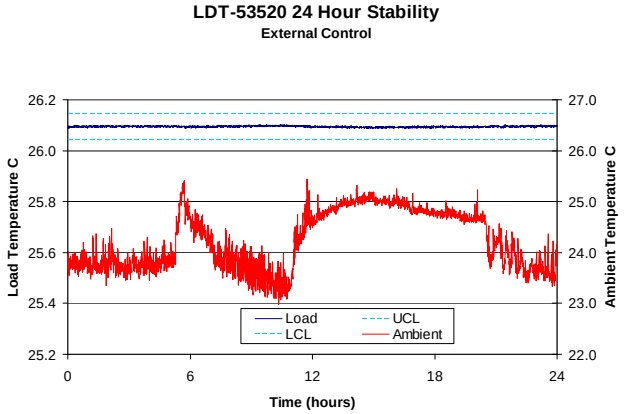

Figure 7

RESULTS

This technical note illustrates the short term and long term temperature stability of the LDT-53500. From the results it can be observed the LDT-53500 series will provide better than ±0.05°C stability approximately 10 minutes after the output has been turned on.