



DI Water Temperature Control

For Series 800, Series 600 and Series LDP Nd:YAG Laser

Use of an External ("City" or Facility) Water Source

The cooling system in the Lee Laser Series 600, Series 800 and some Series LDP lasers uses the flow of external water in the secondary cooling system to control the temperature of the DI water in the reservoir tank of the primary cooling system. External water that circulates through a stainless steel coil inside the tank removes heat from the DI water. Flow control of the external water will maintain a temperature of the DI water within $< 0.5^{\circ}\text{C}$.

1. Series 600 and Series 800 Lasers

For all Series 600 and Series 800 laser models with rated output power up to 100 Watts, Lee Laser uses a passive city Water Flow Valve (P/N 120031). The device has two water flow channels:

- a. temperature sense channel for DI water flow
- b. external water channel that gradually opens and closes according to the temperature of the DI water.

The sense channel of the Water Flow Valve is located on the return water line from the laser optical assembly (FROM HEAD connection at the rear of the power station cabinet). As such, it monitors the temperature of the DI water after it has been heated by the laser flash lamp (Series 600 lasers) or arc lamp (Series 800 lasers). The nominal set-point temperature at which the Water Flow Valve opens and closes is 32°C return DI water temperature from the head.

At constant arc lamp power, the Water Flow Valve will establish a constant flow of incoming external water to maintain some nominal DI water temperature in the reservoir tank within $\pm 0.5^{\circ}\text{C}$. The exact steady-state water temperature will depend on the temperature of the incoming external water, and the power level at which the laser is operated. The typical DI water temperature in the reservoir tank is 27°C with the laser operating at its rated output power level. Depending on the temperature of the external water, and on the power level at which the laser is operated, the steady-state DI water temperature may be as low as 25°C or as high as 28°C .

When a laser is first switched ON, there will be no initial flow of external water. Not until the temperature of the return DI water from the laser head reaches the Water Flow Valve set-point temperature of 32°C will the valve begin to open to permit the flow of external water. There may be some temporary overshoot of DI water temperature, but after approximately 15 minutes, the flow of external water will become constant and the temperature of DI water will stabilize. When a laser is operated at a reduced output power level (arc lamp power level), the steady-state DI water temperature in the reservoir tank normally will be 1-2°C lower than when the laser is operated at its rated output power level.

For TEMoo-mode laser models (such as the 812T, 818T, etc.) in which mode control and power are sensitive to the temperature of the YAG rod, it is important to allow the laser this 15-minute warm up period before attempting any work.

The set-point temperature of the Water Flow Valve is fixed at the factory. No change is possible.

When the laser is switched OFF, the flow of external water will continue for some brief period of time until the sense temperature drops below the 32°C control set point. To reduce this period of external water flow, allow the water pump to continue to operate about five (5) minutes after the arc lamp has been switched OFF. This will accelerate the decrease of the sense temperature.

2. High-Power Series 800 Lasers and Some Series LDP Lasers

For Series 800 lasers with output power rated 150 Watts and greater, and for some Series LDP lasers, Lee Laser uses a solenoid-controlled external water flow valve (P/N 120015). For this, DI water temperature is sensed by a thermistor that is mounted along the DI water return line from the laser head. An electronic circuit controls ON/OFF operation of the Solenoid Water Flow Valve. The temperature set point of the control circuit maintains a constant DI water temperature in the reservoir tank.

Series 800 high-power lasers:	29°C (±)
Series LDP lasers:	22°C (±)

If the end-user's external water source contains high concentrations of dissolved solids or particulate matter, then it is possible that these water flow valves may become stuck in either open or closed positions, which will prevent precise control of DI water temperature. In such situations, an appropriate water filter must be placed on the external water source.

Internally Chilled Series LDP Lasers

Series LDP, Diode-Pumped Nd:YAG Lasers are available with an optional refrigerated chiller. This chiller unit is installed inside the laser's power station cabinet in place of the standard water/water heat exchanger cooling system. The refrigerated chiller will maintain a DI water temperature of 22°C (±) within 0.3°C.

Laser Protection from Insufficient Cooling

All Lee Laser products are protected from damage caused by insufficient cooling capacity provided by the user. Insufficient cooling capacity may consist of the following:

- Insufficient capacity of external cooling water source (insufficient flow)
- External cooling water that is not sufficiently cool (too warm)
- Too warm operating environment or insufficient ventilation for internally chilled Series LDP lasers

In the event of insufficient cooling provision, the following events will occur:

- **Warning of over-temperature operation, Lasers manufactured before 2000.**
 - laser continues to operate
 - Series 800 and Series 600 lasers: warning light illuminates at 32°C
 - Series LDP lasers: warning light illuminates at 25.0°C
- **Over-temperature Interlock (shutdown) of laser**
 - laser shuts down
 - Series 800 and Series 600 lasers: laser shutdown at 38°C
 - Series LDP lasers: laser shutdown at 25.5°C