



## Design Features for Operator Safety

Safe operation of all our laser products is a prime design consideration at Lee Laser. All of our lasers have been engineered to include a variety of safety and interlock features that enhance safe operation.

- 1. International Laser Safety Standards.** All Lee Laser products comply with internationally recognized laser standards. This includes CDRH of the U.S. Food and Drug Administration, American National Standards Institute and the European Committee for Standardization of the European Economic Union.
- 2. Safety Interlock System.** The laser safety interlock system is electrically isolated and current limited for safety and reliability. Voltage is non-hazardous 24 VAC.
- 3. Intracavity Safety Shutter.** The electro-mechanical fail-safe safety shutter is located inside (intra-cavity) the optical resonator. This is absolutely the safest location for a beam block as prescribed by CDRH. When the shutter is closed, its intracavity location prevents all lasing action whatsoever. Therefore, there is no heating of the shutter.

An extra-cavity (located outside the optical resonator) shutter that is used by other laser manufacturers is simply a beam block, and does not prevent lasing action. The extra-cavity shutter must absorb all beam power. It must be water cooled to prevent overheating. Should the cooling fail, the shutter may become damaged, and possibly even fail.

Lee Laser shutter voltage is a safe 18 vdc. Lee Laser uses the intra-cavity safety shutter on all of our laser products, including the Company's most powerful lasers up to 1000 Watts.

**Fail-Safe Shutter Design.** The safety shutter mechanism consists of a steel "flag" that is attached to a rotary solenoid. In the rest position, the "flag" falls into the optical beam path inside the optical resonator. In this position, no lasing action is possible. The beam is totally extinguished.

Manufactured by Ledex and Dormeyer, Inc. of Vandalia, Ohio, the Lee Laser shutter solenoid utilizes a special, proprietary design that permanently bonds the steel "flag" to the solenoid shaft. It is not possible for the "flag" to become separated from the solenoid.

The solenoid is rated by the manufacturer for an extended lifetime of 50 million cycles.

While other laser manufactures may use a similar rotary solenoid/flag design, their “flag” is attached by screws to a rotating disc, which in time may become loose and separated from the solenoid.

4. **Arc Lamp Ignition (Series 600 and Series 800 lasers).** The fail-safe Safety Shutter interlock circuit permits lamp ignition only if the shutter is in the CLOSED position. Lamp ignition with the shutter in the OPEN position is not possible.
5. **“Doors” Interlock.** The “Doors” interlock consists of a circuit loop that a laser system integrator or end user may connect to an interlock switch that is attached to any access door in the laser operational area. The circuit loop is connected in series with the Safety Shutter circuit. When any of the interlocked doors are violated, the safety shutter will close preventing all laser emission.

Every laser includes two “Doors” interlock access connections: a BNC connector at the rear of the power supply, and an insulated wire loop at the output end of the laser optical resonator.

6. **Remote Interlock Connector (RIC).** The RIC provides access to a laser system integrator or end user for immediate total shut down of the laser. Located at the rear of the power supply, the RIC contains a wire loop circuit that, if broken, will switch OFF the laser power supply and cooling system.
7. **Isolation Transformer (Series 800).** Isolation transformer permits power supply and chassis grounds to be at the same potential to eliminate electrical shock and service equipment damage hazards.
8. **Laser Grounding.** All cabinet panels that contain electrical components are grounded. Only a single grounding conductor is attached to each ground point. The AC line cord includes a green grounding (earth) cable for safe grounding from the user’s electrical system.
9. **Electrical Wiring.** All laser wiring conforms to recognized international electrical codes.