



Early Laser Arc Lamp Failure

Common Causes

Arc Lamp Lifetime

Lee Laser's Series 800 lasers use arc lamps that contain the inert gas Krypton. Today's state-of-the-art materials and modern manufacturing processes produce laser arc lamps which yield long performance lifetime and stable operation.

Under normal operating conditions, krypton arc lamps should give many hundreds of hours of satisfactory operation. Arc lamp lifetime can be extended or reduced by the manner in which it is used.

Factors that improve arc lamp lifetime

- Continuous operation
- Operation at reduced current level (maintain laser resonator in good alignment, keep optics clean)
- Periodic replacement of DI Water Filter
- Periodic replacement of arc lamp contact band
- Removal of all broken glass after arc lamp explosion (check particle traps near pump, sharp elbow at water outlet port of head block)
- Follow correct laser start-up and shutdown procedures.

Factors that reduce arc lamp lifetime

- Incorrect (reverse) polarity of the arc lamp. Red tip must always be at (+) terminal
- Frequent arc lamp ignition
- Operation at high current level
- Use of low resistivity DI Water
- Restricted or reduced DI Water flow through the head block
- Incorrect laser shutdown procedure
- Loss of split ring inside lamp contact assembly
- Incorrect (reverse) DI water flow through head block assembly due to improper coolant hose hookup after servicing.

After long hours of use, it is common for the inside of the arc lamp glass envelope to develop a coating which may be black, white or gray. This coating occurs primarily at the cathode (-) end, but may be at the anode (+) end. The coating develops from metallic erosion at the electrodes and devitrification of the glass. It reduces arc lamp efficiency by blocking optical energy from reaching the YAG rod. Severe discoloration can cause arc lamp explosion because it produces hot spots on the glass surface.

Arc lamps which have accumulated long hours of operation also may produce unstable laser beam output power level, especially for TEM₀₀-mode lasers. This results from a movement of the plasma arc around the tips of the electrodes, which is caused by uneven erosion of the electrodes.

When severe discoloration or age related instability of the arc lamp adversely affects laser performance, the arc lamp should be replaced.

Incorrect Lamp Electrical Polarity

The positive (+) electrode of the lamp has been painted with a **red** ink. This end always must be inserted into the contact block (item 21 in Drawing No. 130193, Figure 1) which is located at the (+) end of the head block assembly. For your convenience, a (+) has been machined into the positive end of the head block housing and a (-) into the negative end.

Unnecessary Arc Lamp Ignition

Arc Lamp ignition (lamp start) reduces lamp lifetime. If operation of the laser is not continuous, but interrupted by brief periods of non-use, it may be better to keep the laser operating during periods of non-use, rather than shutdown.

Correct Shutdown Procedure

The correct Laser Shutdown Procedure is listed on page 5-11 of the Operation Manual. It states that the Power Supply is to be shut OFF 2-3 minutes prior to shut off of the DI Water pump (key switch).

Failure to allow the water pump to remain operating after Power Supply shutdown will significantly reduce arc lamp lifetime.

To shut OFF the laser:

1. Set Power Control knob to minimum current
2. Press Power Supply **OFF** pushbutton to shut down power supply
3. Wait 20-30 seconds
4. Turn main keyswitch to **OFF**.

Removal of Broken Glass

Sometimes an arc lamp will explode. Usually it is because the lamp has become very aged.

When an arc lamp explodes, the lamp flow tube may also break.

Broken arc lamp and flow tube glass may be washed away by the flow of the DI Water. Most will become trapped in the Particle Filter next to the water pump. Failure to remove broken glass from the Particle Filter may restrict DI water flow. **The restricted water flow can cause the replacement arc lamp to operate at an elevated temperature which will reduce arc lamp lifetime.**

It is possible that some glass may become trapped in the water outlet elbow fitting underneath the laser head block. This is located below the cathode (-) end of the arc lamp contact assembly. With a long thin tool, probe the water outlet port to determine if glass is present. If glass is found, disconnect the water hose and remove glass.

If broken glass is found inside the gold elliptical reflector cavity, **it must be removed very carefully so as not to scratch the reflective gold plating** (the gold plate also protects the underlying metal from exposure to the water and eventual corrosion). To remove broken glass, Lee Laser recommends a shop vacuum cleaner. **Do not scrape the glass against the gold plate.**

Lamp Contact Assembly Split Ring

The Split Ring serves to absorb the linear thermal expansion of the arc lamp. It is located inside the Lamp Contact Assembly behind the Lamp Contact Band (ref. P/N 21, Dwg. No. 130193, Figure 1). If the arc lamp electrodes are inserted fully into the Lamp Contact Assembly, the thermal expansion of the hot arc lamp will induce compressional stress. The Split Ring allows the lamp to expand.

During replacement of the Lamp Contact Band, it is possible that the Split Ring may become lost. **It must be replaced.**

Best lamp change procedure: Do not insert arc lamp electrodes fully into Lamp Contact Assembly. Allow 1-mm distance between the end of the arc lamp electrode and the Split Ring.

Mechanical Stress on Arc Lamp

During servicing of the Head Block Assembly, it is possible that the top surfaces of the Lamp Contact Bases (P/N 15, Dwg. No. 130193, Figure 1) have become no longer flat and level. This can cause mechanical stress on the arc lamp when the Lamp Contact Assembly is firmly attached.

With the Arc Lamp Assembly removed, a long, thin, flat surface may be used to check that the top surfaces of the Lamp Contact Bases are flat and level. Lee Laser P/N 110016, Installation Bar, is designed specifically for this purpose.

If the top surfaces of the Lamp Contact Bases are found to be not level, slightly loosen the Lamp Power Connectors (P/N 2, Dwg. No. 130193) and tighten again with the Lamp Contact Bases level.

Laser Maintenance and Servicing

Arc lamp lifetime can be improved by operating the lamp at a reduced power level.

From reports by many users we know that those which perform routine service and maintain their lasers in good operating condition always achieve the best arc lamp lifetime. Good operating condition includes periodic check of optical resonator alignment with a laser power (Watt) meter and other test instruments.

Also, the gold elliptical reflector should be checked for its condition, and the DI (deionization) water filter should be changed periodically to maintain the proper electrolytic level and oxygen removal (see Lee Laser bulletin, **Deionized Water Quality**).

Clearly, if the optical resonator is properly aligned and the gold pump chamber is in good condition, the laser will operate most efficiently. Less arc lamp power will be needed to produce the beam power necessary for your work.

Disposal of Used or Defective Laser Arc Lamps

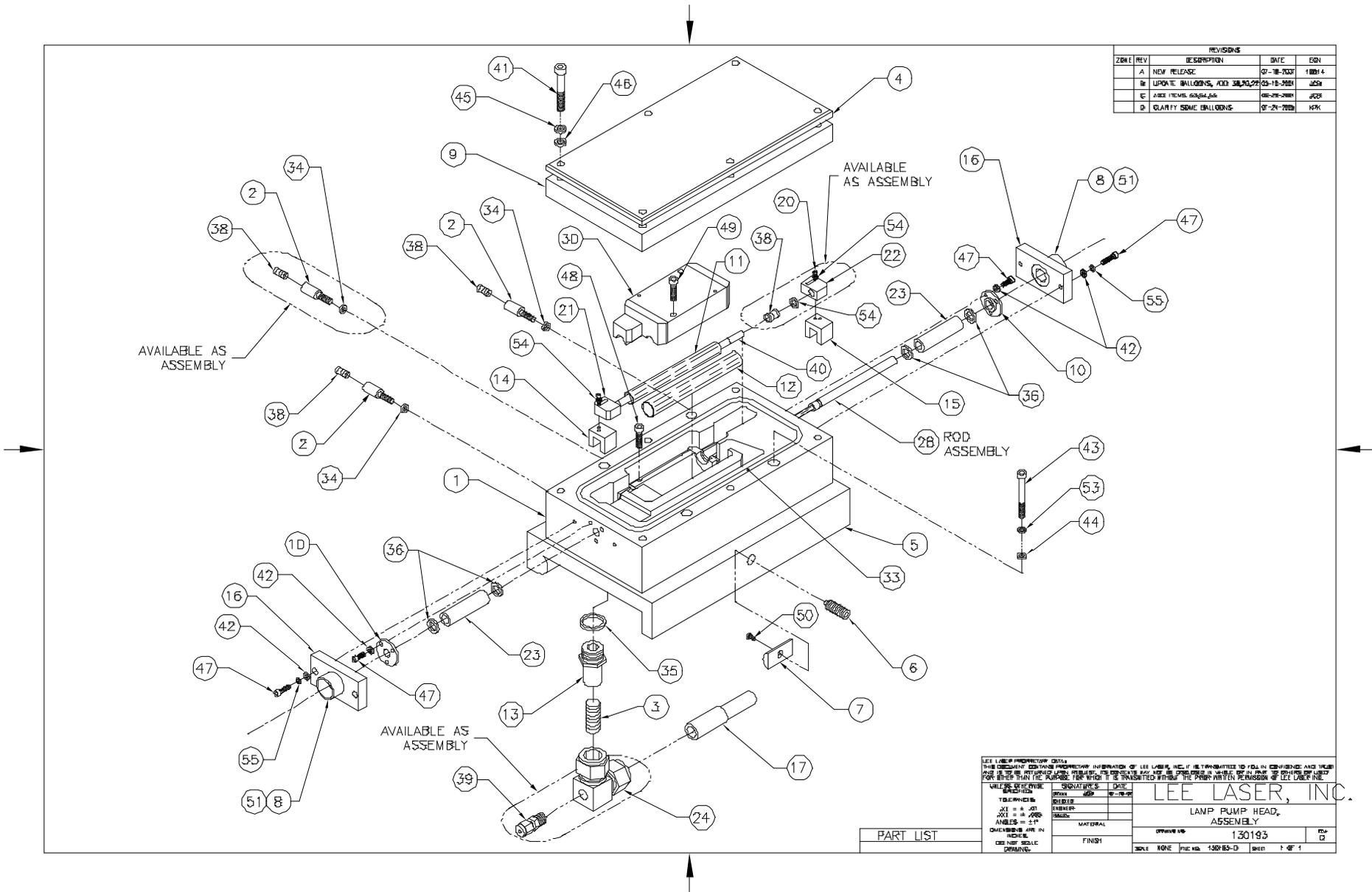
Laser arc lamps are manufactured totally from inert materials: glass, stainless steel, tungsten and krypton gas. As such, used or defective laser arc lamps, including broken arc lamps, may be discarded without fear of any harm to the environment.

Users should consult your local or business environmental office or agency for the correct disposal procedure in your area.

Differences in Arc Lamp Appearance

Lee Laser purchases laser arc lamps from several different manufacturers. Each manufacturer may use slightly different design details for the internal electrode, so the lamps from one manufacturer may differ slightly in appearance from those of another manufacturer.

However, all of the lamps that are specified by Lee Laser for use in a particular laser model will have the same dimensions (length and envelope diameter), the same gas fill pressure and the same operating voltage (within manufacturing tolerances). As such, all of the lamps bear the same performance warranty by Lee Laser, regardless of manufacturer. Arc lamp manufacturers provide no warranty whatsoever.



| REVISIONS | | | |
|-----------|-----------------------------------|------------|-------|
| REV | DESCRIPTION | DATE | ESN |
| A | NEW RELEASE | 07-18-2003 | 18914 |
| B | UPDATE BALLBOUNDS, ADD 38, 42, 49 | 03-15-2004 | 18914 |
| C | ADD ITEMS 50, 55 | 06-25-2004 | 18914 |
| D | CLARIFY SOME BALLBOUNDS | 07-24-2004 | KPK |

| LEE LASER PRODUCTION DATA | | | |
|--|------------|--------------|----------|
| THIS DOCUMENT AND THE INFORMATION CONTAINED HEREIN ARE UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE AND THIS INFORMATION IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE. THIS INFORMATION IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE. | | | |
| DATE OF RELEASE | 07-18-2003 | SIGNATURES | DATE |
| DESIGNED BY | ... | DESIGNED BY | ... |
| DRAWN BY | ... | DRAWN BY | ... |
| CHECKED BY | ... | CHECKED BY | ... |
| APPROVED BY | ... | APPROVED BY | ... |
| MATERIAL | | FINISH | |
| ORDER NO. | 130193 | REV | 02 |
| SIZE | NGK | FILE NO. | 130193-D |
| SHEET | 1 | TOTAL SHEETS | 1 |

PART LIST

Figure 1, Lamp-Pumped Head Assembly