

X-Cite® Guide

X-Cite® 120 Series Maintenance & Troubleshooting Guide

1. Introduction

This guide contains installation, maintenance and troubleshooting tips to help optimize the lifetime and performance of X-Cite® 120 series and components. This information is intended to supplement the detailed installation and operating instructions found in the X-Cite® User Manuals.

Topics covered include liquid light guides, lamps, and air vents – the components most likely to affect performance over time and require maintenance or replacement. Note that the lifetime information on components is for typical or average conditions. Depending on the imaging application, more frequent replacement may be required—for example, if a fluorophore's signal is low to begin with, or is excited by a low power portion of the X-Cite® lamp's output spectrum.

2. Liquid Light Guides

2.1 Proper handling and installation of liquid light guides

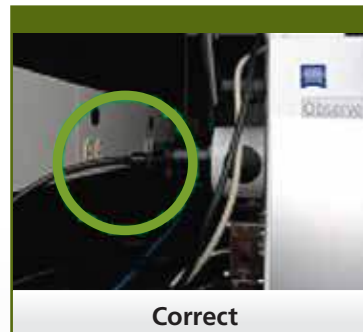
Liquid light guides have a typical useful life of 4000 hours of operation when handled properly and installed in a well maintained X-Cite® 120. The formation of bubbles is one of the most common reasons for a light guide to degrade prematurely and result in a sudden reduction in illumination intensity. Bubbles can form without warning, and if they occur within the first 1500 to 2000 hours of use, it is typically due to overheating and/or mechanical stress to the light guide. Below are some simple tips to avoid overheating and stressing the light guide.

1. Always fully insert the light guide into the X-Cite® unit (i.e. up to the white line); this ensures contact with a heat sink to conduct heat away from the light guide.

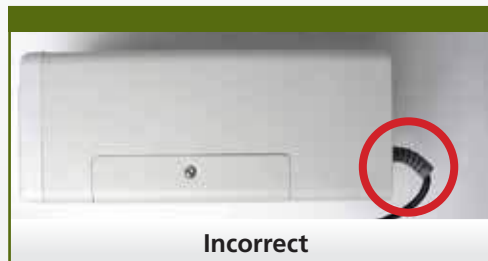


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2. Always allow adequate clearance at the rear of the X-Cite® unit and microscope to prevent excessive bending and/or crushing of the light guide against walls. Minimum bend radius to prevent immediate damage to the LLG is 40mm, however, a bend radius of at least 75mm is recommended for a light guide while "in use". Sharper bends can cause heat to build up and cause problems longer term.



3. Always place the X-Cite® unit close enough to the microscope so that there is some slack in the light guide and no sharp bends.



4. Never leave an endcap on the output end of the light guide when the other end is connected to the X-Cite® unit; if the unit is turned on in this condition, the cap will overheat, melt and/or permanently discolour the quartz end of the light guide.
5. Do not expose the light guide to extreme temperatures (above 35°C, below -5°C) for extended periods of time during use, transport or storage; this may cause degradation of the seals and allow air bubbles to form in the liquid.

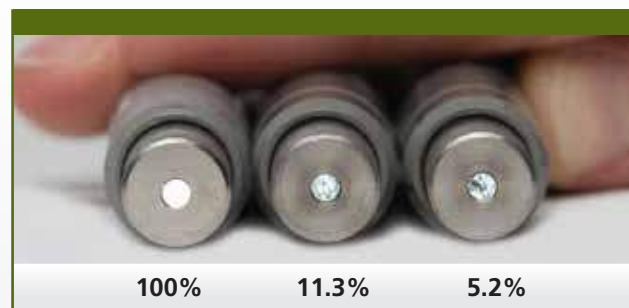
2.2 What does a bubble look like?

Depending on the size and location in the light guide, a bubble may or may not be obvious. To check for bubbles:

1. Disconnect the LLG from the X-Cite® and microscope adapter.
2. Hold one end towards a bright window or overhead room light - DO NOT use an X-Cite® or any other focused light source for this test!

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3. Look at the quartz at the other end of the LLG
 - a. Bubble-free: quartz end will appear as a bright, solid circle; you may also be able to see a thin circular outline at the quartz/liquid interface.
 - b. Bubbles at/near the quartz end: appear as dark spots, as small as 0.5mm in diameter or even as larger more defined spheres.
 - c. Bubbles in the middle of the light guide: may not be well-defined spots, but will appear as dark shadows.
 - d. In extreme cases, where the bubble is blocking the entire diameter of the light guide, no light will come through, even when pointing the distal end at a light source.



Appearance and % output of light guides with bubbles relative to an LLG without bubbles (100%).

2.3 Can a bubbled light guide recover?

Yes, light guides with small bubbles can sometimes recover. Disconnect the light guide from the X-Cite® unit, and leave the light guide undisturbed on a shelf for 1-2 weeks. For this to be effective, it is important to catch the bubble when it is small.

2.4 When should light guides be replaced?

It is usually time to replace a light guide when:

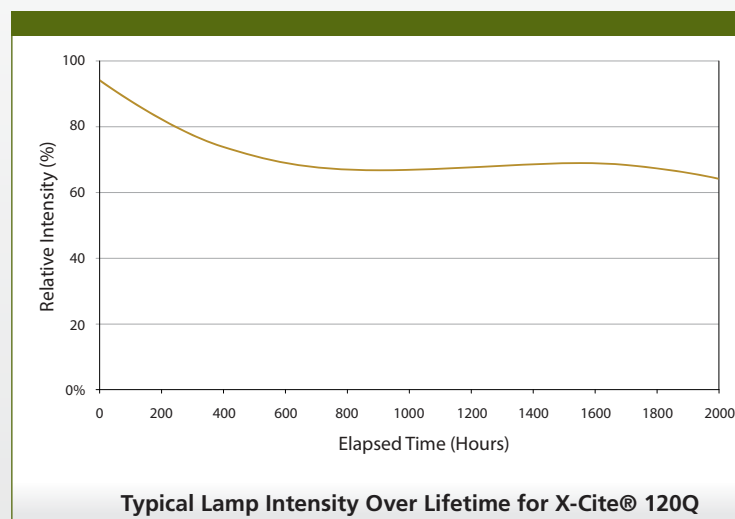
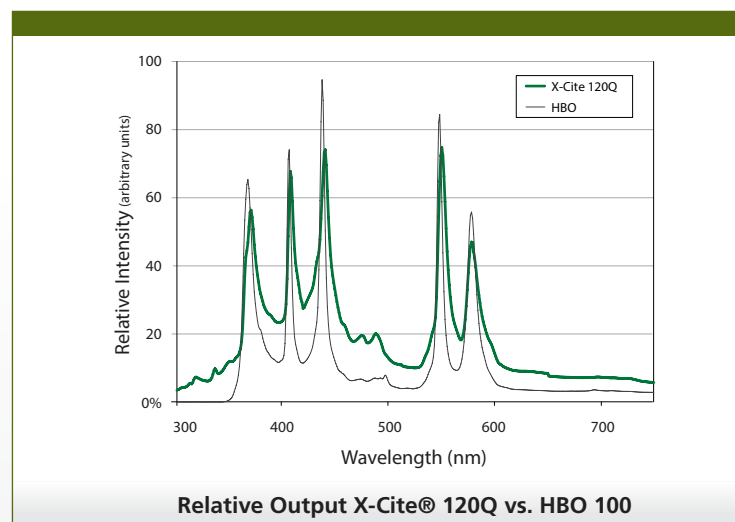
- Illumination is low and replacing the lamp does not improve brightness
- Dark or uneven areas become visible in the field of view (a bubble is blocking part of the light)
- A section of the light guide becomes noticeably warmer than the rest of the guide (a bubble is blocking transmission of light, forcing the light guide to absorb the energy)
- It is 2-3 years old OR has been in use for 4000-6000 hours (2-3 lamp changes), when handled properly in a well maintained unit.

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3. Lamps

3.1 Performance and lifetime

The lamp output spectra and typical output levels over lifetime are shown below.



It is normal for the output to decline over the first several hundred hours of use and then stabilize at a level ~70% of the initial output for the remainder of the lamp life. If the lower power regions of the output spectra are being used, it may be desirable to replace lamps more frequently to maximize signal levels.

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3.2 General tips to help maximize lamp lifetime

1. Each time the lamp is ignited, the stress on the lamp effectively decreases lamp life by 5 hours, therefore it is recommended to avoid shutting down the unit during lunch or short breaks or between users, if being used in a multi-user lab
2. After lamp ignition, avoid turning the lamp off until it has run for a minimum of 20 minutes
3. Avoid attempting to strike a hot lamp (note: the X-Cite®'s Intelli-Lamp® will prevent this)
4. Avoid unnecessary movement and jarring of the lamp, especially when it is in operation or hot
5. When changing a lamp:
 - a. Handle the lamp only by the ceramic areas
 - b. Never touch the glass envelope of the bulb (inner stem), the inner surface, or the outer surface of the reflector. If touched, carefully clean the envelope with alcohol. Skin oils can etch the glass and cause premature bulb failure
 - c. Wear cotton gloves or powder free latex/nitrile gloves when handling any lamp
6. Ensure that air filters are kept clear of dust and debris – even a partially blocked filter can reduce lamp lifetime to approximately 25% of what is normally expected.

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4. Air Vents and Filters

X-Cite® units have several air vents that are an integral part of the cooling system and overall lamp performance. Proper cooling ensures that lamps operate at optimal temperature and pressure for output power, spectrum, lamp life, light guide life and safety.

4.1 Ensuring adequate cooling

1. Never obstruct the air vents on the X-Cite® unit. Vents are located at the rear and underside of the unit. (Note: Arrows indicate direction/location of air flow. In earlier X-Cite® models vents were located on the side, underneath the lamp access panel.)



2. Always leave clearance for air flow between the X-Cite® and walls or other equipment. Do not remove the rubber feet on the X-Cite® unit or otherwise reduce/block the space between the bottom of the unit and bench top. This may compromise airflow through the unit.

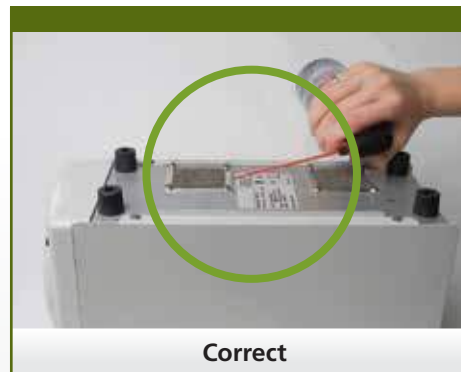


3. Ensure that the air being used to ventilate the X-Cite® unit is approximately "room temperature" (e.g. do not place the X-Cite® unit on top of another heat-producing instrument).
4. If a heated environmental chamber is being used for live cell imaging, make sure that the X-Cite® unit and the light guide are located outside of the chamber.
5. Periodically check the air filter at the air intake vent for debris. Replace or clean as necessary.

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4.2 How to check/clean X-Cite® 120XL/Q metal vents

1. When unit is OFF and lamp is COOL, unplug the power from the X-Cite® unit and turn the unit upside down. Visually inspect the metal gratings for lint, dust and other debris.
2. Debris can be removed from the gratings using a small vacuum cleaner with a crevice tool, or blown out with a can of compressed air. If using compressed air, direct the air flow ACROSS the vents, not perpendicularly (i.e. into the X-Cite® unit).



4.3 How to check/clean X-Cite® 120 (original design) nylon foam filters

1. Visually inspect the perforations on the side of the unit, under the lamp access door. You should be able to see a grey mesh filter on the inside of the unit. This filter requires cleaning or replacing if:
 - Dust/lint/debris has accumulated
 - Dust/lint/debris is blocking the view of the grey mesh filter
 - The filter looks as though it is crumbling
2. It is possible to clean newer filters, but it is generally better to replace them, as they tend to deteriorate over time (one reason they stopped being used in X-Cite® units in 2006). Contact Lumen Dynamics Technical Support for additional information on cleaning/replacing filters.

4.4 What happens if filters are not clean?

A complete filter blockage or airflow obstruction generally results in an automatic lamp shutoff within 10-15 minutes of the unit being powered on due to lack of adequate cooling.

A partially clogged filter may allow enough airflow for continued operation, but not for optimal cooling. In this case, the result is usually a dramatic reduction in lamp life, e.g. 400 hours instead of 2500+ hours, it may also cause bubbles to form in the light guide.