

Beam Purge Gas System

The beam delivery system is comprised of a mechanical bellows that provides a clean, dry atmosphere for the beam after it leaves the resonator output coupler to be transferred by reflective optics to the work piece. The laser beam itself must be protected when being transmitted from one mirror to another. Beam distortion may occur in the presence of airborne particles and vapors in the beam delivery tubes. This can be avoided by purging the tubes using a CONCOA 605 or 603 Series Regulator to deliver moisture and particle-free gas. Depending on the manufacturer and model of laser, the beam purge gas may be supplied by an oil-free compressor, on-site nitrogen supply, or membrane system.

Typical Beam Purge Gas Requirements

Beam Purge Gas	Grade	Purity	Pressure	Flow Rate
Nitrogen (N ₂)	4.5	99.995%	20 - 80 PSIG	100 - 1200 CFH

The use of “house air” can cause contamination of the beam delivery optics since the presence of oil, water, and dirt can be found in most shop air lines. It is ideal that the laser has its own air supply system. This is important in the event the shop air system is incapable of meeting the laser’s demand and other processes at the same time. The use of filters and traps can be a time-consuming and expensive procedure to maintain the compressor air purity; CONCOA’s 5239 Beam Purge Regulator is a good choice to deliver bulk nitrogen as an economical alternative.

Laser manufacturers are currently integrating membrane technology to not only supply clean, dry air, but also nitrogen for process applications. Membranes offer several advantages, such as modular design allowing future expansion, low maintenance costs (no moving parts), and low energy requirements. Membranes for gas separation are made of polymers in the form of hollow fibers. Gases pass through certain membrane materials at different rates, allowing selective separation. In the case of a beam purge system, a compressor supplies an air supply to the membrane in which dry air permeates through and moisture is evacuated. The effective flow rate out of the system is directly related to the pressure drop across the membrane, the type of polymer fibers, fiber thickness, and solubility of the desired gas. A membrane system can be custom-designed to meet the purity requirements, flow capacity, and type of gas output for either purging or assist gas applications. In either application, CONCOA’s 603 Series Line Regulator meets the demand with a high-flow balanced stem seat. Purity is not sacrificed because the 5239 and 603 both offer a 1×10^{-8} scc/sec leak integrity and a stainless steel diaphragm.

