

SITE PREPARATION
FOR
EMG 100/200 SERIES
EXCIMER-MULTI-GAS LASERS

Thank you for buying from Lambda Physik. We appreciate the confidence you have shown in our laser, and we hope it gives you many thousands of hours of reliable operation. Should there ever be a problem, please do not hesitate to call us.

Your laser is scheduled for delivery on approximately _____. The following information will help you prepare your facility before delivery so there will be no undue delays before operation.

A. Utilities

1. Power. The laser requires 208-240 volts, 3-phase, 60 Hz, 3kW maximum. A 20 amp 3-phase line is appropriate and can be either 4-wire (3-phases plus ground) or 5-wire (add a neutral). The laser comes with a 5-wire color coded 4 meter cable but no connector. The neutral line can be tied to the ground line in 4-wire systems. The color code (marked on the rear of the power supply) is black, black, brown for the three phases, blue for neutral, and green/yellow for ground.

2. Water. All lasers except for the EMG 100 require 2-4 liters/min cooling water. The water line should have a shut-off valve and 25 micron particulate filter (available from Sears or plumbing supply stores). The maximum pressure at the laser should not exceed 5 psi; however, a pressure regulator is not necessary. Simply insure that the water outlet goes to an open drain and the inlet valve is opened to the appropriate flow rate. Please note that excess pressure can cause a leak in the laser, the results of which can be very unpleasant.

3. Pump oil. The pump is filled with the appropriate amount of oil and one spare liter (two fills) is provided. This oil is standard 30W non-detergent motor oil. Consult the rear section of the manual for recommended types.

4. Exhaust tube. The air exhaust part of the laser is equipped with a flange and approximately 3 meters of 6" diameter flexible hose. This exhaust hose should be vented to a fume hood or the outdoors in case of a gas leak in the laser. If you must extend this hose beyond 3 meters, consider adding a fan at the output end to improve the gas flow.

B. Gas System. The performance of the laser depends critically on the purity of the gases used. Water vapor is particularly damaging and should be kept below 3-4 ppm. Be aware that contaminants can be

introduced by the gas regulators and fill lines as well as by the gas cylinders themselves.

1. Gases. The enclosed gas table shows the type and approximate quantity of gas required for each wavelength. Note that fluorine and chlorine (as HCl) should be ordered as 5% concentrations in helium for safety.

Recommended gas suppliers are also shown on the enclosed sheet. Generally they specialize in high-purity gases; those not listed have either not qualified their gases for use in our laser or have provided inconsistent quality. If in doubt about a supplier, ask us - we hear about all the problems.

Beware of standard laboratory gases which have been stored in their cylinders for more than a few months. Old helium and argon have caused considerable trouble. Considering the cost of the laser, fresh gases are a good investment.

Request that all inert gases listed be supplied with CGA 580 connectors to minimize the number of fittings required. Research grade Xe, Kr, and Ne are sometimes supplied with left-handed CGA 590 connections unless otherwise requested. F₂He is CGA 670 while HCl/He is CGA 330; both are left-handed for safety.

2. Regulators. All regulators should be single-stage and evacuable, with an outboard shut-off valve and Parker CPI fitting for 6mm tubing.

For the inert gases, select "high purity" or "diffusion-resistant" regulators with a brass body and stainless steel diaphragm. The high and low pressure gauges should span 0-3000 psi and 0-60 psi respectively except for Xe and Kr for which the inlet pressure does not exceed 1000 psi.

For the corrosive gases, all components should be 316 stainless steel, including the regulator diaphragm. For safety, the shut-off valve should be a diaphragm type with very low leakage. Suitable halogen gas regulators are available from the listed gas suppliers. We do not recommend using one regulator for both fluorine and chlorine.

3. Delivery tubing. The laser is supplied with four 3-meter coils of tubing with end fittings to connect the regulators to the laser. Three coils are 6 mm plastic tubing while the fourth is 6 mm copper tubing for the halogen. Alternately, 1/4" stainless steel or poly-flow tubing can be used, if tube fittings are also exchanged. Do not mix metric and english connections.

4. Vacuum pump exhaust. The halogen filter effectively removes the dangerous gases from the exhaust, but the vacuum pump outlet should be vented to avoid oil vapor contamination. Use a 3/4" garden hose.

C. Safety.

1. Safety goggles. To protect against the invisible UV output, Lambda Physik suggests LGS-NN goggles from

Glendale Optical
130 Crossways Park Drive
Woodbury, NY 11797
(516)921-5800

2. Interlocks. An external interlock connector is provided which requires a contact closure to enable laser operation. This connector comes with the contact closure pre-wired, but an external switch activated by a door closure, for example, can be used to interlock laser operation.

3. Halogen cabinet. Due to the hazardous nature of the halogens, we recommend storing these gas cylinders in an enclosed cabinet which is vented to the outdoors. Such cabinets are priced in the range of \$500-1000 and are available from

Capco
900 Main Street
Peekskill, NY 10566
(914)737-0561

As an alternative, consider storing the cylinders outdoors or under a fume hood.

D. Output Power/Energy Measurements.

1. Pulse energy. One of the most effective pulse energy detectors is a pyroelectric joulemeter, Model ED-500, made by

Gen-Tec Inc.
Electro-Optics Div.
2625 Dalton Street
Quebec, G1P 3S9, Canada
(418)651-8000

This 2" square detector sells for about \$1015 and easily captures the entire beam. The output is a long-tail pulse to an oscilloscope. Because of the long time constant of the detector, accurate measurements cannot be made above 2 pps.

2. Average power. An inexpensive (\$175) yet very effective average power meter is the Model 25A Power Probe made by

Optical Engineering Inc.
P.O. Box 696
3300 Coffee Lane
Santa Rosa, CA 95402
(707)528-1060

This is a thermophile detector which is inserted into the beam for 20 seconds. Average powers to 20 watts are read directly from the dial. Of course, the laser cannot be adjusted using this detector.

A more versatile type of constant reading power meter is made by

Sciencetech Inc.
5649 Arapahoe Avenue
Boulder, CO 80303
(303)444-1361

Various models are available in 1" and 4" diameters. (Unfortunately, the 1" size is slightly smaller than our beam.) and the new black coating appears very damage-resistant.

E. Tools. All tools, metric and English, required to perform normal service on the laser are provided.

F. Installation. When the laser is set in place and ready for operation, arrange for an installation visit. The installation engineer will explain the operation and service of the laser and measure pulse energy and average power with your choice of excimer gas or dye. Plan on one-half day for installation and training.

G. Spare parts. All common spare parts are stocked at Lambda Physik for immediate delivery. In addition, the manual will list those parts you might consider purchasing for service once your warranty has expired.

H. Check List. Have you taken care of:

- Main power — 203V 4 wire need plug
- Water — get { filter valves
- Exhaust line
- Vacuum pump vent
- Gases
- Regulators
- Safety goggles
- Power meters

REQUIRED GASES

<u>Gas</u>	<u>Purity</u>	<u>Order Qty</u>	<u>Required For</u>	<u>Qty/Fill</u>
Helium	99.995%	330 cu ft	All	3 cu ft
Krypton	99.99	50-100 liters	KrF	4 liters
Xenon	99.99	50-100 liters	XeF, XeCl	1-2 liters
Argon	99.995	330 cu ft	ArF, XeCl	0.5 cu ft
Neon	99.995	1400 liters	F ₂ , ArF	7-9 liters
F ₂ /He (5%)	98.0 (F ₂)	60 cu ft	F ₂ , (X)F	0.2 cu ft
HCl/He (5%)	99.995	60 cu ft	XeCl	0.1 cu ft
Nitrogen	99.99	330 cu ft	N ₂	0.05 cu ft

*NOTICE XeCl operation in all lasers except EMG 200E and 201E and older series with integrated preionization require first run Neon as buffer gas.

GAS SUPPLIERS

Airco Ind. Gases (617) 263-7769
Union Landing & River Road (602) 273-1255 - Southwest
Riverton, NJ 08077 (408) 727-5470 - West

Cryogenic Rare Gas Labs, Inc. (201) 548-9600
46 Liberty Street
Metuchen, NJ 08840

MG Scientific Gases (201) 231-9595
175 Meister Avenue
P.O. Box 5328
North Branch, NJ 08876

Spectra Gases, Inc. (201) 483-0257
320 Mt. Pleasant Ave.
Newark, NJ 07104

LAMBDA PHYSIK EXCIMER LASERS STANDARD GAS MIXTURES (All pressures in Millibar Units)

Laser Medium	EMG 50E	EMG 100/1/2	EMG 101/2/3	EMG 101/2/3MSC	EMG 200/1(E)	EMG 200/1(E)	EMG 201/2/3MSC	EMG 52/53MSC
Wavelength		integrated preionization until Dec. 1983	strip preionization since 1984		Chlorine version	Fluorine version		
F2 157 nm	Ne	90	90	90	90	90		
F25%/He95%	Ne	250	250	250	250	250		
TOTAL	He	2,310	2,660	2,310	2,660	2,310		
	TOTAL	2,650	3,000	2,650	3,000	2,650		
ArF 193 nm	Ar	150	150	150	150	150		
F25%/He95%	Ar	350	350	350	350	350		
TOTAL	Ne	1,700	1,700	1,700	1,300	1,300		
	He	1,300	1,700	1,700	1,300	1,300		
	TOTAL	1,800	2,200	2,200	1,800	1,800		
HCl15%/He95%	Kr	200	200	200	200	200		
KrCl 229 nm	He	2,130	2,130	2,050	2,130	2,130		
TOTAL	He	2,400	2,400	2,500	2,400	2,400		
F25%/He95%	Kr	120	120	120	120	120		
KrF 248 nm	Ne	150	150	150	150	150		
He	Ne	2,230	2,230	2,230	1,630	1,630		
TOTAL	He	2,500	2,500	2,500	2,500	2,500		
HCl15%/He95%	Xe	80	80	80	80	80		
XeCl 306 nm	Ar	80	80	80	100	60		
He	Ne	2,420	2,420	2,420	1,110	1,110		
Neon	Neon	2,360	2,420	2,420	---	---		
Neon 70*	Neon	2,420	2,420	2,420	2,420	2,420		
TOTAL	Neon	2,600	2,600	2,600	2,600	2,600		
N2 337 nm	N2	60	60	60	60	40		
He	He	940	940	940	940	960		
TOTAL	He	1,000	1,000	1,000	1,000	1,000		
F25%/He95%	Xe	220	220	220	220	220		
XeF 351 nm	He	20	20	20	20	20		
He	He	2,260	2,260	2,260	1,860	1,860		
TOTAL	Ne	2,500	2,500	2,500	2,500	2,500		

GAS MINIMUM PURITY GAS MINIMUM PURITY GAS MINIMUM PURITY

Helium Grade 4.5 (99.995%) Neon Grade 4.0 (99.99%) Nitrogen Grade 4.0 (99.99%)

Krypton Grade 4.0 (99.99%) Neon 70 (70% Ne + 30% He) Carbon Dioxide Grade 4.0 (99.99%)

Neon Grade 4.0 (99.99%) Mixture: F25%/He95% Purity F2 = 3.0 (99.9%)

Neon Grade 4.5 (99.995%) Mixture: F25%/He95% HCl = 4.5 (99.995%)

with Neon 70 is economical but maximum power is decreased approximately by 15% in the case of EMG 203 MSC