

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. F<sub>2</sub>He 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

Scientech 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 <sub>2</sub> , ArF	7-9 liters
F <sub>2</sub> /He (5%)	98.0 (F <sub>2</sub> )	60 cu ft	F <sub>2</sub> , (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 <sub>2</sub>	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

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

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

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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 integrated preioniza- tion until Dec. 1983	EMG 101/2/3 strip preioni- zation since 1984	EMG 101/2/3MSC	EMG 200/1(E) Chlorine version	EMG 200/1(E) Fluorine version	EMG 201/2/3MSC	EMG 52/53MSC
Wavelength								
F <sub>2</sub> 157 nm	F <sub>2</sub> 5%/He95% Ne He TOTAL	90 250 2,310 2,650	90 250 2,660 3,000	90 250 2,310 2,650	90 250 2,660 3,000	90 250 2,310 2,650		
ArF 193 nm	F <sub>2</sub> 5%/He95% Ar Ne He TOTAL	150 350 --- 1,700 2,200	150 350 --- 1,300 1,800	150 350 --- 1,700 2,200	150 350 --- 1,700 2,200	150 350 --- 1,300 1,800	150 350 --- 1,300 1,800	120 270 --- 1,410 1,800
KrCl 229 nm	HC15%/He95% Kr He TOTAL	70 200 2,130 2,400	70 200 2,130 2,400	100 350 2,050 2,500	70 200 2,130 2,400			
KrF 248 nm	F <sub>2</sub> 5%/He95% Kr Ne He TOTAL	120 150 --- 2,230 2,500	120 120 --- 2,260 2,500	120 150 --- 2,230 2,500	120 150 --- 2,230 2,500	120 150 600 1,630 2,500	120 150 600 1,630 2,500	80 120 --- 2,300 2,500
XeCl 308 nm	HC15%/He95% Xe Ar He Neon Neon 70* TOTAL	100 80 --- 2,420 --- 2,420 2,600	100 80 --- 2,360 --- 2,420 1,250	100 80 --- 2,420 --- 2,420 2,600	80 100 --- 2,420 --- 2,420 2,600	80 60 1,110 --- --- --- 1,250	80 60 --- --- 2,760 2,760* 2,900	80 100 --- --- --- 1,320 1,500
N <sub>2</sub> 337 nm	N <sub>2</sub> He TOTAL	60 940 1,000	40 960 1,000	60 940 1,000	60 940 1,000	40 960 1,000	40 960 1,000	
XeF 351 nm	F <sub>2</sub> 5%/He95% Xe He Ne TOTAL	220 20 2,260 2,500	220 20 2,260 2,500	220 20 2,260 2,500	220 20 2,260 2,500	220 20 1,860 400 2,500	220 20 1,860 400 2,500	120 20 2,570 1,260 1,500

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%)
Xenon	Grade 4.0 (99.99%)	Mixture: F <sub>2</sub> 5%/He95%		Purity F <sub>2</sub>	= 3.0 (99.9%)
Neon	Grade 4.5 (99.995%)	Mixture: F <sub>2</sub> 5%/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