

# ***Excimer Immersion Microstepper*** **XIS193 / 248**



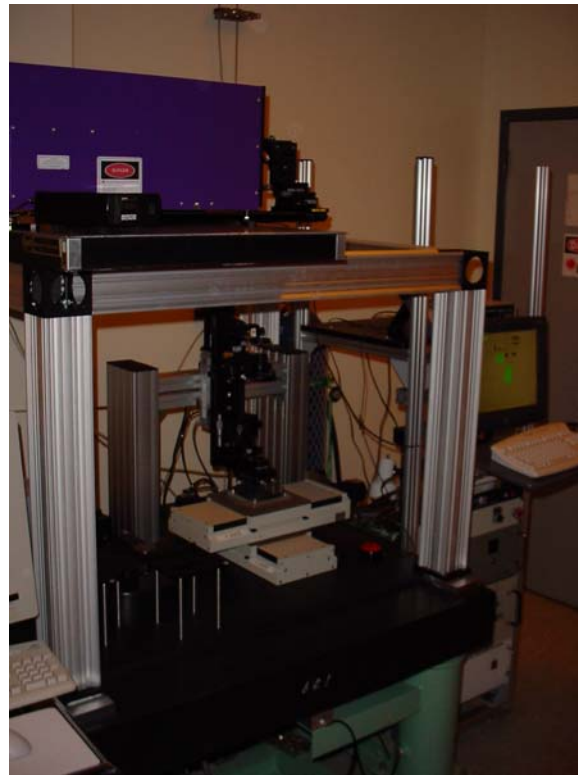
*High-NA water immersion excimer laser stepper  
system for lithography research and development*

# ***Excimer Immersion Microstepper XIS-193***

Compact  
Excimer  
Laser

Optical  
Column

200mm  
stage



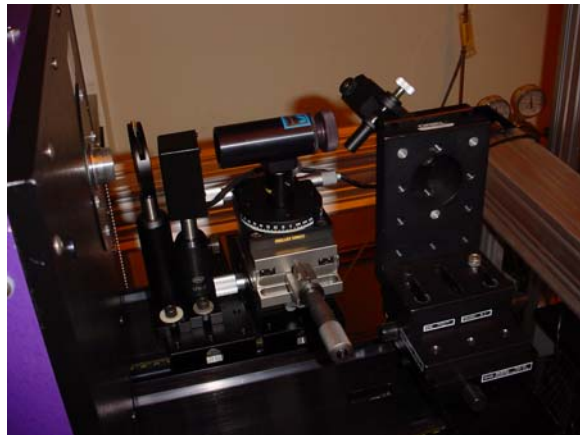
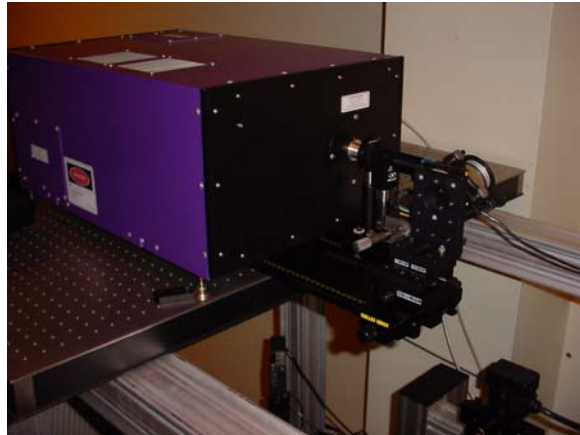
Graphical  
Interface

Stage and  
Robotic  
Controllers



# *Excimer Immersion Microstepper XIS-193*

Beam  
Delivery  
and  
Illumination  
System



Optical  
Column

Polarizer

PS Mask  
Plane

High NA  
Imaging  
Lens

200mm  
Stage

# Immersion Phase-shift Lithography using Smith-Talbot Lens

Phase-shift lithography using a chromeless PSM and a Smith-Talbot interference lens

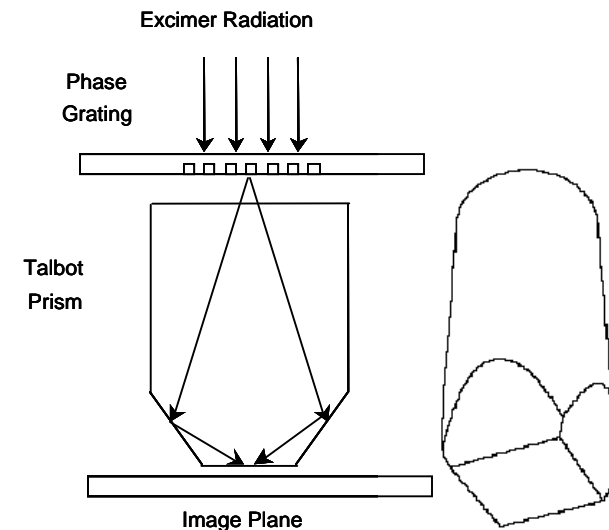
Operation at 193nm or 248nm possible using commercial  $\pi_{193}$  or  $\pi_{248}$  phase shift mask gratings

Dual wavelength tool available

High-NA water immersion operation at 0.80 to 1.35NA for 60nm to 36nm resolution

Line/space and contact patterns are possible

Standard UV optical components used for polarization and beam delivery



## 193 Prism Lens Designs

NA	half-pitch
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0.8	60nm
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1.05	45nm
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1.20	40nm
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1.35	36nm
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# Lambda Physik OPTexProT-ROM

Small-footprint line-narrowed 193-nm excimer laser designed to meet the demanding specifications of immersion photolithography

OPTexPro*	F2**	ArF	KrF	XeCl	XeF	
Wavelength	157	193	248	308	351	nm
Max. Pulse Energy	1	10	17	8	8	mJ
Max. Average Power	0.5	4	8	4	3	W
Max. Repetition Rate	500	500	500	500	500	Hz
Energy Stability (1 $\sigma$ )	n/a	3	3	3	3	%
Pulse Duration (FWHM, typ.)	n/a	10	10	10	10	ns
Beam Dimensions (v x h, FWHM, typ.)	n/a	6x3	6x3	6x3	6x3	mm <sup>2</sup>
Part No. 16113250 (193 nm, 115 V, 230 V, 50/60 Hz) 16113210 (308 nm, 115 V, 230 V, 50/60 Hz)						

Dimensions (l x w x h)	Laser head: 605 x 304 x 450 mm <sup>3</sup> / 24 x 12 x 18 in
Weight	Laser head: 73 kg / 161 lbs



**LAMBDA PHYSIK®**

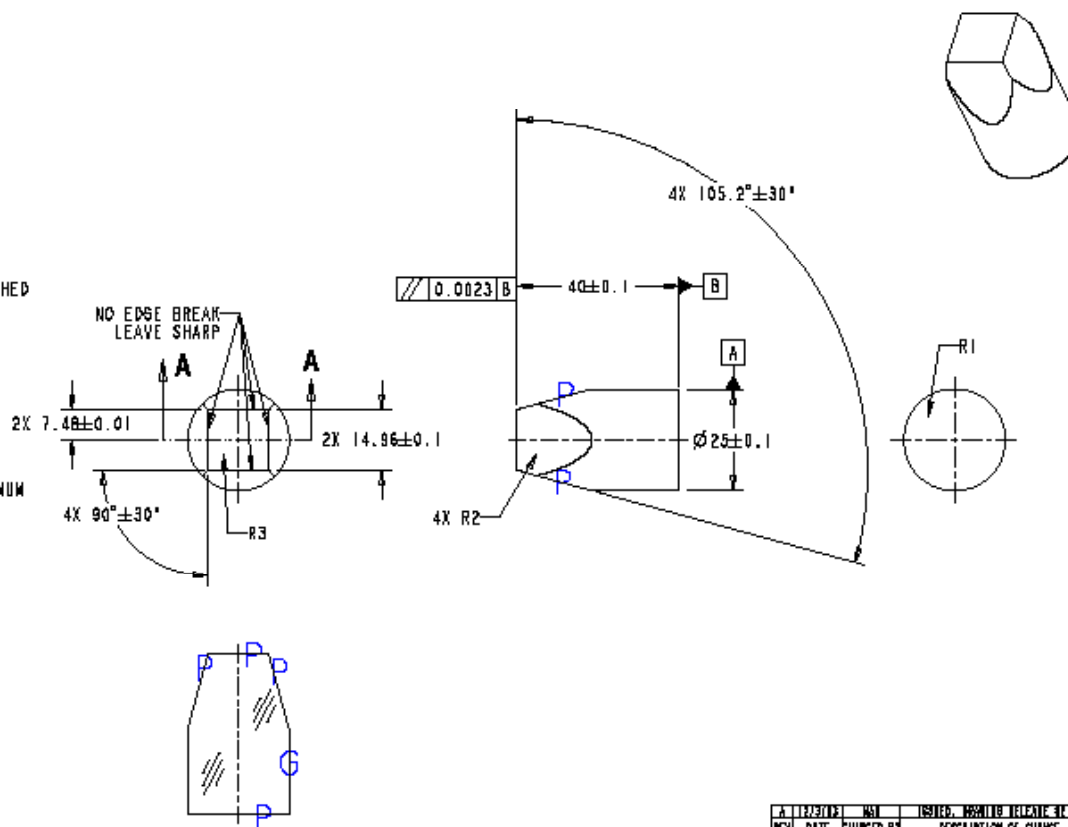
Driving the Pulse of UV Technology

# 1.05NA Smith Talbot Lens

## 45nm half-pitch resolution

### NOTES:

1. DIMENSIONS ARE METRIC: MM
2. MATERIAL:  
TYPE - ARF GRADE FUSED SILICA  
  
STRAIE - GRADE A OR BETTER  
HOMOGENEITY -  $\Delta n_d$  VARIATION -  $\pm 1 \times 10^{-6}$   
STRESS BIREFRINGENCE -  $< 4 \text{ nm/cm}$   
BUBBLES & SEEDS - GRADE 0
3. CHAMFER: HAND BREAK ALL EDGES .5mm MAX,  
UNLESS OTHERWISE SPECIFIED
4. NOMENCLATURE:  
B - BLACKENED; G - FINE GROUND; P - POLISHED
5. POLISHED SURFACES:  
POWER (FR0632.8nm) - 0.2fr  
IRREG (FR0632.8nm) - 0.2fr  
SCRATCH-DIG - 20-10  
GREY - NONE  
STAIN - NONE
6. COATING TYPE:  
R1 - AR  $\leq 0.5\%$  @ 193nm, 0° INCIDENCE, MINIMUM  
APERTURE 23MM.  
R2 - AL COATING ON FULL SURFACE, 4 FACETS.  
R3 - NONE



SECTION A-A

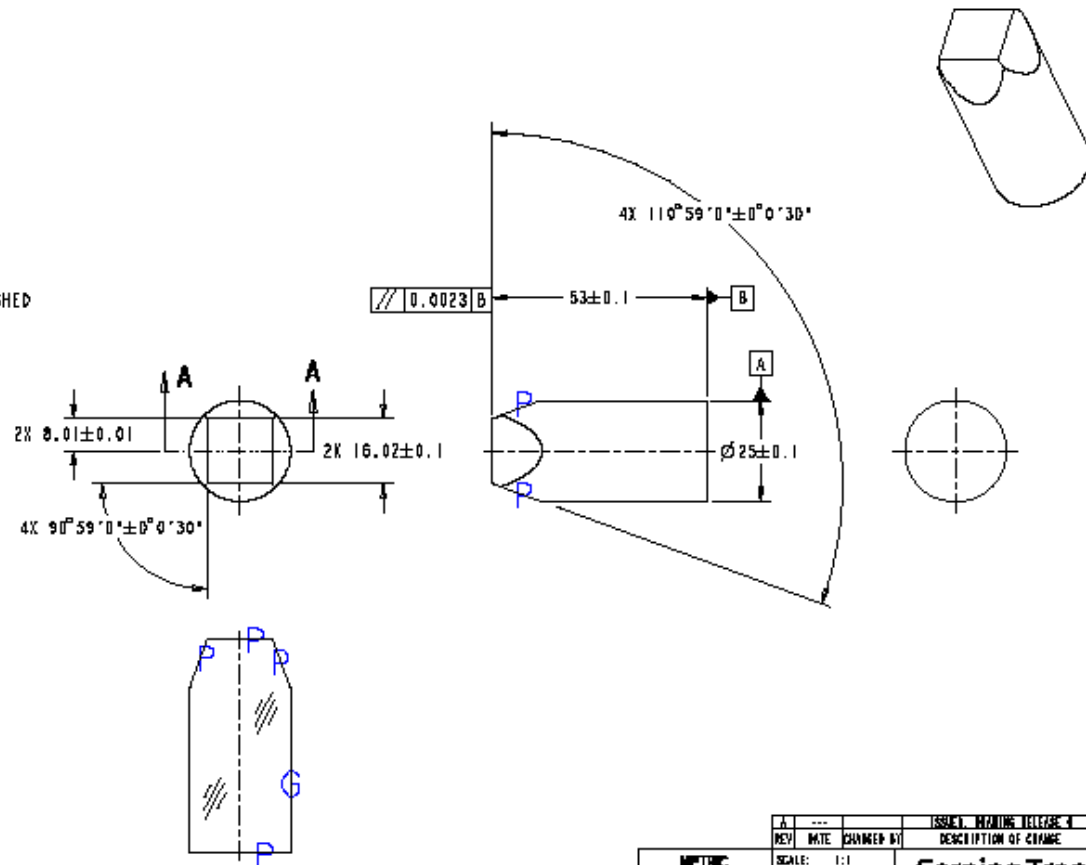
A 12/2003		REV	DATE	CHANGED BY	DESCRIPTION OF CHANGE	REV	DATE
SCALE: 1:1		Corning Tropol					
DATE: 12/1/03		PROJECT: SMITH-TALBOT					
DRI: M. HALLIN		PART NAME: ST-1.05NA					
CHD: G. PARKER		MEET ASST: ---					
APT: G. PARKER		FIBER ASST: ---					
OPT. DEC: ---		B-145876					
RELEASE LEVEL: Production		REV A					

# 1.20NA Smith Talbot Lens

## 40nm half-pitch resolution

### NOTES:

1. DIMENSIONS ARE METRIC: MM
2. MATERIAL:  
TYPE - ArF GRADE FUSED SILICA  
  
STRAIE - GRADE A OR BETTER  
HOMOGENEITY -  $\Delta n$  VARIATION -  $\pm 1 \times 10^{-6}$   
STRESS BIREFRINGENCE -  $< 4 \text{ nm/cm}$   
BUBBLES & SEEDS - GRADE D
3. CHAMFER: HAND BREAK ALL EDGES .5mm MAX, UNLESS OTHERWISE SPECIFIED
4. NONENCLATURE:  
B - BLACKENED; G - FINE GROUND; P - POLISHED
5. POLISHED SURFACES:  
POWER (FR0632.8nm) - 0.5fr  
IRREG (FR0632.8nm) - 0.2 fr  
SCRATCH-DIG - 20-10  
GREY - NONE  
STAIN - NONE



SECTION A-A

REV		DATE	CHANGED BY	ISSUED BY	DESCRIPTION OF CHANGE	ECN
SCALE: 1:1		Corning Tropel				
DATE: 1/24/08		PROJECT: SMITH-TALBOT				
DWN: B. PARKER		PART NAME: TT-1.20A				
APPD: B. PARKER		NEXT REV: ---				
OPT. REV: ---		FINAL REV: ---				
NEXT REV: ---		B-145501				
FINAL REV: ---		10				

RELEASE LEVEL

# Graphical System Interface

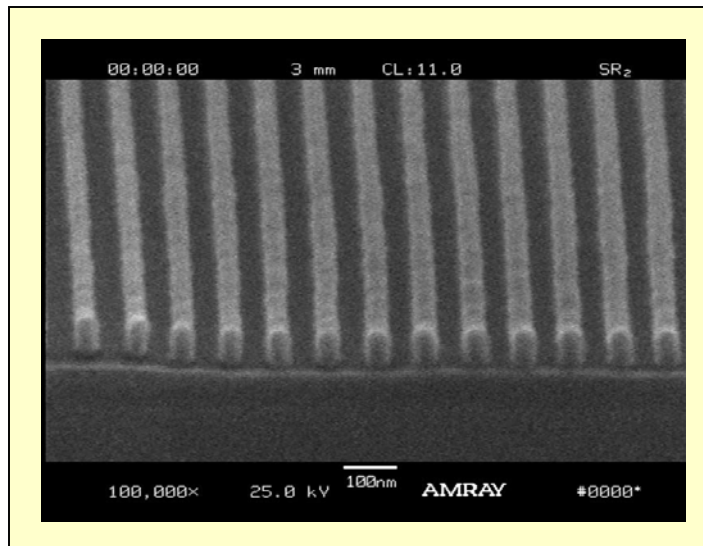
The screenshot displays a graphical user interface for a stepper system, organized into several functional sections:

- Top Menu Bar:** Contains buttons for File..., Setup..., Alignment..., Parameters..., Reports..., and Save...
- SETUP Section:**
  - Wafer Size:** Radio buttons for 200mm and 150mm.
  - Columns, Step Size, Rows, Step Size, Start Exp, Increment, Gap, Modulation:** Input fields for configuring the exposure process.
  - ARRAY TYPE:** Radio buttons for Exposure Only, Exposure/Gap, and Exposure/Demodulation.
  - Start Gap, Increment, Start Demod., Increment:** Input fields for array parameters.
- STAGE Section:**
  - GO, HOME, CENTER:** Buttons for stage movement.
  - 0 0 0 X Y Z:** Input fields for stage coordinates.
  - Manual Robot:** A button for manual robot control.
  - Load1, Unload1:** Buttons for wafer loading and unloading.
- OPERATE Section:**
  - Laser, Vacuum, Load, Unload, Expose, Map Height, Abort:** Buttons for operating the stepper.
- Right Panel:**
  - Set Program, Operator:** Dropdown menus for program and operator selection.
  - Wafer ID:** A text field displaying A7851200.
  - New Run, Vacuum, Single Wafer, Append Wafer, Robot Utilities...:** Buttons for running and managing the process.
- Bottom Section:**
  - Axis Absolute Relative User Coord:** A table for coordinate settings.
  - Reject, Col, Row, N, Step um, by Die, GoTo:** Input fields and buttons for reject and coordinate management.
  - Navigation Pad:** A set of directional buttons (Up, Down, Left, Right) and a central F button.
  - 256:** A numerical display.
- Taskbar:** Shows the Start button and the application name RIT\_Immersion\_Stepper - ...
- System Clock:** Displays the time as 3:41 PM.

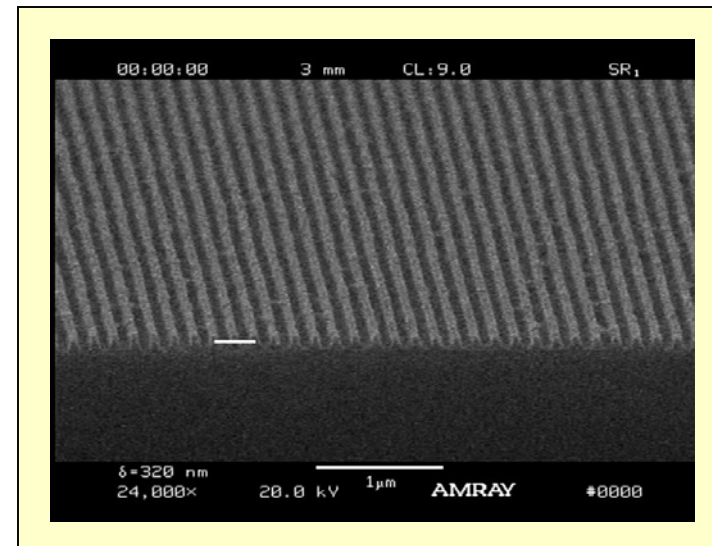


# Resist Imaging Results

***193nm 1.05NA***  
***45nm resolution***



***248nm 0.82NA***  
***75nm resolution***



## **I. SYSTEM CAPABILITIES**

### **A. IMAGING PERFORMANCE**

Wavelength	193nm (ArF) or 248nm (KrF)
Optics system	Smith-Talbot lens (Corning Tropel)
NA	0.80, 1.05, 1.20
Resolution	60nm, 45nm, 40nm half-pitch (@193nm)
Wafer Size	150 and 200mm
Exposure area	2mm diameter field
Field uniformity	90% image contrast over 1mm and 10% uniformity
Irradiance at wafer	0.2 to 50 mW/cm <sup>2</sup>
Exposure throughput	0.2 to 50 mJ/cm <sup>2</sup> per second
Minimum exposure	0.01 mJ/cm <sup>2</sup>
DOF	500 microns at 1.05NA

### **B. SYSTEM PERFORMANCE**

X-Y stage travel	200 mm
X-Y stage accuracy	1 micrometer
Z stage travel	50 mm
Z stage accuracy	0.5 micrometer
Laser temporal coherence	< 10pm
Laser spatial coherence	> 250 micrometers
Laser energy	> 2mJ/pulse
Laser rep rate	200 Hz

## II. SYSTEM DESCRIPTION

### A. WEIGHTS AND DIMENSIONS

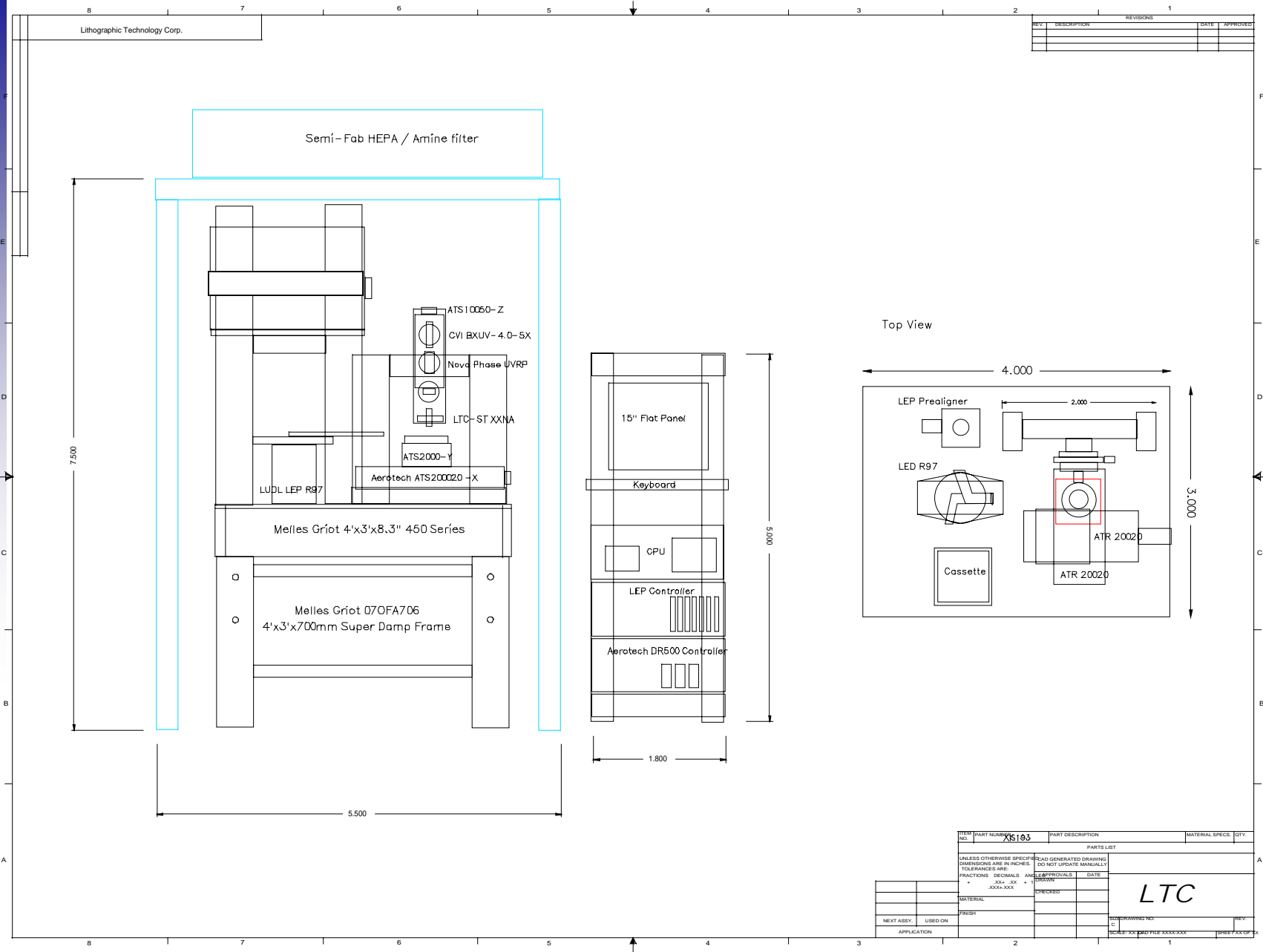
(all dimensions in mm and weights in kg unless noted)

XIS 193		Width	Depth	Height	Weight	Comments
1	Exposure Tool	900	1200	1200	100	Optical column, stages, and robot
2	<i>FabFloor Pedestal</i>	<i>1500</i>	<i>1500</i>	<i>300</i>	<i>400</i>	<i>Optional Newport subfloor pedestal</i>
3	Workstation Frame	900	1200	700	200	Self leveling isolation frame
4	Optical Tabletop	900	1200	210	300	
5	GAM Laser	430	630	300	50	Laser supported by electronics rack
6	Electronics Rack	560	560	2000	150	Controls, CPU, and monitor
7	Gas Cabinet					User supplied

### B. SERVICES

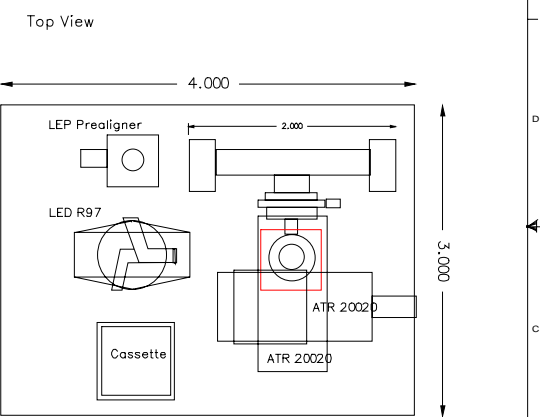
Gases, air, vacuum, and exhaust						
			Gases	Delivery		
1	Lambda Physik OpTex Pro T-ROM		0.17% F2 6% Ar 1% He Helium Bal. Ne N2 Exhaust			See OpTex Pro manual for specifications
2	Workstation Frame		CDA	100 psi		Line Narrowing purge, 10-100 cc/min. 1/4" Swagelock to 3/4" flexible hose
3	Exposure Tool		PV	200 mbar		Compressed Air CDA, isolation mounts
			CDA	100 psi		Regulated process vacuum, wafer chuck
4	Gas Cabinet		Exhaust			Mask actuator, regulated Exhaust as specified by user (160-230 m3/h)

Electrical				
			Service	
1	Exposure tool and rack		110-125 VAC 47/63 Hz	Total requirements for system including
2	Laser		110-125 VAC 47/63 Hz	laser 20Amp



Lithographic Technology Corp.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



ITEM NO.	PART NUMBER	PART DESCRIPTION	MATERIAL SPEC.	QTY.
XLS193				
PARTS LIST				
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. FRACTIONS: DECIMALS: ANGLES: TOLERANCES ARE:		READ GENERATED DRAWINGS. DO NOT UPDATE MANUALLY.		
APPROVALS		DATE	DESIGN	
CHECKED				
MATERIAL				
FINISH				
NEXT ASST.		USED ON		
APPLICATION				

**LTC**

DRAWING NO. C

SCALE: XX:1 (20 FILE XXXXX)X

SHEET XX OF XX