

CSIR- NATIONAL PHYSICAL LABORATORY

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From: Director, CSIR-NPL

Ref No. 14-VIII/AKS(23-GTE)2024PB/T-180

Dated : 16.01.2025

CORRIGENDUM

With reference to NPL's Global Tender ID: **2025_CSIR_783894_1**, for the procurement of "Maskless Laser Writer for Lithography". Consequent upon the outcome of PBC, **some changes have been made in the technical specification of captioned tender. Revised specifications are as follows:**
Final Specs after Pre-Bid Meeting

FINAL DETAILED TECHNICAL SPECIFICATIONS

Annexure 1: Technical Specification for Maskless Laser Writer for Lithography

1.	Primary application	Maskless laser writer for lithography	
2.	Variable Resolution, feature details, and Writing Modes	2.1	Lowest feature size: ≤ 0.6 micron.
		2.2	Write structures line by line.
		2.3	Writing long lines without breaking boundary.
		2.4	Raster scan/strip-by-strip/step and repeat writing mode.
		2.5	Critical dimension uniformity (CDU) / Line width uniformity (LDU) [3σ]: ≤ 200 nm.
		2.6	Line edge roughness (LER): $\leq \pm 50$ nm.
		2.7	Variable resolution with different spot sizes: Minimum three spot sizes are required in the 0.6 to 5 μm range. Change of spot sizes should be automated.
		2.8	Freehand exposure mode/Draw mode: It must be possible to draw structures directly into a live camera image of the substrate and directly expose these.
3.	Substrate details	3.1	Minimum substrate size to be handled: $\leq 5 \times 5$ mm ² .
		3.2	Maximum substrate size to be handled: $\geq 150 \times 150$ mm ² .
		3.3	Maximum substrate thickness to be accommodated: ≥ 10 mm.
4.	Light source	4.1	Two automatically selectable light sources should be included with the following wavelengths: (i) 400 ± 10 nm and

			(ii) 375 ± 10 nm
		4.2	Intensity controlled.
		4.3	Autofocus should be available.
		4.4	$\geq 10,000$ hours of operational lifetime for each light source.
5.	Exposure/Write Area	$\geq 100 \times 100 \text{mm}^2$	
6.	Stage	6.1	Fully motorized X-Y stage with movement resolution ≤ 20 nm.
		6.2	Anti-vibration table to be provided.
7.	Alignment accuracy, focus, and camera	7.1	Automatic wafer alignment.
		7.2	Camera-supported alignment.
		7.3	Overlay alignment accuracy for sample size $\leq 5 \times 5 \text{mm}^2$: ≤ 500 nm.
		7.4	Automatic optical focus is required.
		7.5	Dynamic range of autofocus should be $\geq 150 \mu\text{m}$.
		7.6	Appropriate camera/microscope should be provided for sample monitoring/visualization, positioning, and marker identification.
		7.7	A live image of the substrate should be visible during exposure.
8.	Writing speed	8.1	$\geq 10 \text{mm}^2/\text{minute}$ for $\leq 0.6 \mu\text{m}$ spot size in raster scan/strip-by-strip/step and repeat, writing mode.
		8.2	$50 \times 50 \text{mm}^2$ area should be written with 100% pixel exposure/100% fill factor and $0.6 \mu\text{m}$ spot size in ≤ 300 minutes.
9.	Compatibility	The system should be compatible with the class 1000 cleanroom environment.	
10.	Process software	10.1	The system must process the CAD formats like DXF, CIF, BMP (grayscale), and Gerber.
		10.2	PC/Front panel displaying equipment and process status along with appropriate software to be supplied.
		10.3	Complete logs of all the process and system parameters to be available and stored for future troubleshooting.
		10.4	Graphical representation of tool and process parameters.
		10.5	CAD layout editor for designing structures.
		10.6	Future Software upgrades should be free of cost for at least 10 years after the installation of the system.
		10.7	If the software is MS Windows based, then Windows version Windows 10 or later will be accepted.
11.	Safety	The tool must come with a complement of interlocks to prevent common user errors.	

12.	Standard component	12.1	PC with graphical user interface.
		12.2	Table for the keyboard and monitor of the system control PC.
13.	Spares and support	Availability of spares and support should be guaranteed for the next 10 years after installation.	
14	Warranty	1 year	
15	Training	5 days of training after installation to 5 users at the installation site	
16	Installation requirements, technical support	16.1	Necessary pre-installation advice, including power requirements, should be enclosed along with the offer.
		16.2	At least two factory-trained technical people should be available in India to provide technical support/service for the quoted system.
		16.3	Suitable photoresist (negative/positive), developer, and remover, required to write structures fulfilling acceptance criteria during testing/installation/commissioning of the system, should be supplied.
17	Previous installations	Minimum one system of the quoted model should be installed in India or abroad.	
18	Acceptance criteria	Fulfillment of writing speed requirements mentioned in S. No. 8.	

Documentary evidence (scientific publications, brochures, catalogue, website) demonstrating and validating quoted features of the system must be available on demand

All other terms & conditions, due date and opening date of said tender will remain the same.

Sr. Controller of Stores & Purchase

TSC Minutes

The PBC/TSC meeting was held on 7th January 2025 at the Director’s conference room, Main building, to finalize the technical specifications of “Maskless Laser Writer Lithography”.

The meeting was attended by all the TSC members.

Based on the Pre-bid meeting and recommendation of I/O, following changes have been made in the specifications:

Original Specifications	Final Specifications	
<p>2.</p> <p>Variable Resolution, feature details, and Writing Modes:</p> <ul style="list-style-type: none"> • Lowest feature size: ≤ 0.6 micron. • Write structures line by line. • Writing long lines without breaking boundary. • Critical dimension uniformity (CDU) / Line width uniformity (LDU): $\leq \pm 100$ nm. • Line edge roughness (LER): $\leq \pm 50$ nm. • Variable resolution with different spot sizes: Minimum three spot sizes are required in the 0.6 to 5 μm range. Change of spot sizes should be automated. • Free hand exposure mode/Draw mode: It must be possible to draw structures directly into a live camera image of the substrate and directly expose these. 	2.	Variable Resolution, feature details, and Writing Modes:
	2.1	Lowest feature size: ≤ 0.6 micron.
	2.2	Write structures line by line.
	2.3	Writing long lines without breaking boundary.
	2.4	Raster scan/strip-by-strip/step and repeat writing mode.
	2.5	Critical dimension uniformity (CDU) / Line width uniformity (LDU) [3σ]: ≤ 200 nm.
	2.6	Line edge roughness (LER): $\leq \pm 50$ nm.
	2.7	Variable resolution with different spot sizes: Minimum three spot sizes are required in the 0.6 to 5 μm range. Change of spot sizes should be automated.
	2.8	Freehand exposure mode/Draw mode: It must be possible to draw structures directly into a live camera image of the substrate and directly expose these.

<p>8. Writing speed:</p> <ul style="list-style-type: none"> • $\geq 10 \text{ mm}^2/\text{minute}$ for $\leq 0.6 \text{ }\mu\text{m}$ spot size. • $50 \times 50 \text{ mm}^2$ area should be written with 100% pixel exposure and $0.6 \text{ }\mu\text{m}$ spot size in ≤ 300 minutes. 	<p>8. Writing speed:</p> <table border="1"> <tr> <td>8.1</td> <td>$\geq 10 \text{ mm}^2/\text{minute}$ for $\leq 0.6 \text{ }\mu\text{m}$ spot size in raster scan/strip-by-strip/step and repeat, writing mode.</td> </tr> <tr> <td>8.2</td> <td>$50 \times 50 \text{ mm}^2$ area should be written with 100% pixel exposure/100% fill factor and $0.6 \text{ }\mu\text{m}$ spot size in ≤ 300 minutes.</td> </tr> </table>	8.1	$\geq 10 \text{ mm}^2/\text{minute}$ for $\leq 0.6 \text{ }\mu\text{m}$ spot size in raster scan/strip-by-strip/step and repeat, writing mode.	8.2	$50 \times 50 \text{ mm}^2$ area should be written with 100% pixel exposure/100% fill factor and $0.6 \text{ }\mu\text{m}$ spot size in ≤ 300 minutes.
8.1	$\geq 10 \text{ mm}^2/\text{minute}$ for $\leq 0.6 \text{ }\mu\text{m}$ spot size in raster scan/strip-by-strip/step and repeat, writing mode.				
8.2	$50 \times 50 \text{ mm}^2$ area should be written with 100% pixel exposure/100% fill factor and $0.6 \text{ }\mu\text{m}$ spot size in ≤ 300 minutes.				
<p>It was not included in the original specifications.</p>	<p>18. Acceptance criteria:</p> <p>Fulfilment of writing speed requirements mentioned in S. No. 8.</p>				
<p>16. Installation requirements, technical support:</p> <ul style="list-style-type: none"> • Suitable photoresist, developer, and remover, required to write structures during testing/installation/commissioning of the system, should be supplied. 	<p>16. Installation requirements, technical support:</p> <p>Suitable photoresist (negative/positive), developer, and remover, required to write structures fulfilling acceptance criteria during testing/installation/commissioning of the system, should be supplied.</p>				
<p>10. Process software:</p> <ul style="list-style-type: none"> • The system must process the CAD formats DXF, CIF, GDSII/GDS2, BMP (grayscale), and Gerber. 	<p>10. Process software:</p> <p>10.1: The system must process the CAD formats like DXF, CIF, BMP (grayscale), and Gerber.</p>				
<p>17. Previous installations:</p> <ul style="list-style-type: none"> • Minimum one system of the quoted model should be installed in India. 	<p>17. Previous installations:</p> <p>Minimum one system of the quoted model should be installed in India or abroad.</p>				

The formatting of the technical specifications has also been revised as suggested by the TSC. In the revised technical specification document, various technical specifications are now listed as serial numbers and respective sub-serial numbers instead of listing these as just bullet points in the previously uploaded version.

Indentor's recommendation on requestes/queries raised in Pre-bid Conference Meeting

Name of Indentor: Ajay Kumar Shukla

Indent No.: PR2054532024

Tender No.: 14-VIII/AKS(23-GTE)24PB/T-180

Item Description: Maskless Laser Writer Lithography

Project No.: OLP240232 (STS Number: INS202402)

Estimated Cost (in INR): 200.00 Lakhs

No. of Budgetary Quotes: 02

(1) As per the recommendations of the 1st TSC meeting dated 26th December 2024, a pre-bid conference (PBC) meeting was held online on 7th January 2025 at the Director's conference room, Main building, CSIR-NPL. The following firms participated in the PBC meeting:

(i) LABINDIA INSTRUMENTS PVT LTD, Gurgaon, India; OEM: Heidelberg Instruments Mikrotechnik GmbH, Germany

(ii) Quantum Design India, Navi Mumbai, India; OEM: Durham Magneto Optics Ltd, United Kingdom

(iii) Global Marketing Services, Bengaluru, India; OEM: Microtech srl, Italy

(iv) HTL Co. (India) Pvt. Ltd, Bengaluru, India; OEM: Nano System Solutions, Japan

(v) Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India; OEM: ABM-USA, Inc., USA

2. Participating bidders raised the following queries:

Name of the Firm	Queries Raised	Remarks, if any
LABINDIA INSTRUMENTS PVT LTD, Gurgaon, India	S.No 2 – Tender's specs - Critical dimension uniformity (CDU) / Line width uniformity (LDU): $\leq \pm 100$ nm. Our request: request you please modify above specs as critical dimension uniformity $[3\sigma, \text{nm}] \leq 200\text{nm}$ S.No 8 Tender's specs – writing speed 10mm ² /min for $\leq 0.6\mu\text{m}$. Our Request: writing speed 10mm ² /min for $\leq 0.6\mu\text{m}$ in raster mode Tender's specs -50x50mm ² area should be written with 100% pixel exposure and 0.6 μm spot size in ≤ 300 minutes Our Request: 50x50mm ² area should be written with 100% pixel /100% Fill factor exposure and 0.6 μm spot size in 250 minutes	

Quantum Design India, Navi Mumbai, India	NIL	No queries were raised by the firm.
Global Marketing Services, Bengaluru, India	<p>In the published specs, the requested speed is ≥ 10 mm²/minute for ≤ 0.6 μm spot size while we offer 8mm²/minute for ≤ 0.5 μm spot size</p> <p>50x50mm² area should be written with 100% pixel exposure and 0.6 μm spot size in ≤ 300 minutes while we offer the same area can be written in 320 minutes with 0.5 μm spot size.</p> <p>Acceptance criteria should be specified.</p> <p>More clarity is required about the type of photoresists to be supplied.</p>	
HTL Co. (India) Pvt. Ltd, Bengaluru, India	<p>Tender's specs - Critical dimension uniformity (CDU) / Line width uniformity (LDU): $\leq \pm 100$ nm.</p> <p>Request: request you to please modify the above specs as CDU/LDU ≤ 200nm</p> <p>LED & Laser both acceptable?</p> <p>Gray Scale Level?</p> <p>Back Side Alignment?</p>	
Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India	<ol style="list-style-type: none"> 1. Write structures line by line – We did not understand this. 2. Max substrate size: IS Substrate size 100x100mm² enough or do you need 150mmx150mm 3. Is only one light source wavelength 405 nm (enough power to expose thick SU8 series 2000, 3000, 6000 with great quality)? Do you really need second line? 4. Automatic wafer alignment – it is never fully automatic (speaking for R&D applications, where there are always different substrates), what does this mean? 5. Live image visible during exposure – live image of the substrate or exposure process? We do show live image of the pattern part being exposed) 6. writing speed – ok, but what does it mean 100% pixel exposure and 0.6 μm spot size – where is the point there? 7. GDSII/GDS2 is not supported in the existing version, DXF, BMP, ... yes 8. Suitable photoresist, developer, and remover required to write structures during testing/installation/commissioning of the system, should be supplied.? - Do we need to quote plasma Asher also – what developer are you looking at? 9. There is no system installed in India yet. Is this, OK? However, we have many systems supplied globally in Europe, China, and US etc. 	

Indentor's recommendation

The comments, as received from bidders during PBC, and our response is as follows:

Tender Specification and its number	Comment of participating firm/OEM in PBC	Response of Indentor (Accepted/ Not accepted)	Revised specification (If any)	Justification for non-acceptance
2. Variable Resolution, feature details, and Writing Modes: Critical dimension uniformity (CDU) / Line width uniformity (LDU): $\leq \pm 100$ nm.	Modify above specs as critical dimension uniformity $[3\sigma, \text{nm}] \leq 200\text{nm}$ (LABINDIA INSTRUMENTS PVT LTD, Gurgaon, India)	Accepted	Critical dimension uniformity (CDU) / Line width uniformity (LDU) $[3\sigma]: \leq 200$ nm.	
8. Writing speed: ≥ 10 mm ² /minute for ≤ 0.6 μm spot size.	Writing speed 10mm ² /min for $\leq 0.6\mu\text{m}$ in raster mode (LABINDIA INSTRUMENTS PVT LTD, Gurgaon, India)	Accepted	≥ 10 mm ² /minute for ≤ 0.6 μm spot size in raster scan/strip-by-strip writing/step and repeat, writing mode.	
8. Writing speed: 50x50mm ² area should be written with 100% pixel exposure and 0.6 μm spot size in ≤ 300 minutes.	50x50mm ² area should be written with 100% pixel /100% Fill factor exposure and 0.6 μm spot size in 250 minutes (LABINDIA INSTRUMENTS PVT LTD, Gurgaon, India)	Partially accepted	50x50mm ² area should be written with 100% pixel exposure/100% fill factor and 0.6 μm spot size in ≤ 300 minutes.	The request to include a 100% fill factor as an alternative terminology for 100% pixel exposure has been accepted. However, the request to change the writing time from ≤ 300 minutes to 250 minutes is not accepted due to the following reason: (i) The quantification of the writing time ≤ 300 minutes has been deliberated in detail and agreed upon by TSC as it fulfills our planned writing requirements. (ii) Reducing required writing time further may be detrimental to wider participation in the bidding as some of the the bidders already satisfying our writing time requirement (≤ 300 minutes) may not satisfy the lower (250 min) writing speed suggested by the firm.
8. Writing speed: ≥ 10 mm ² /minute for ≤ 0.6 μm spot size. 50x50mm ² area should be written with 100% pixel exposure and 0.6 μm	We offer 8mm ² /minute for ≤ 0.5 μm spot size 50x50mm ² area should be written with 100% pixel exposure and 0.6 μm spot size in ≤ 300 minutes while we offer the same area can be written in 320 minutes	Not accepted		Writing speed, dictating the overall time required to write a given area, is one of the most important performance parameters for a mask-less laser writer. The quantification of the writing time ≤ 300 minutes has been deliberated in detail

spot size in \leq 300 minutes.	with 0.5 μ m spot size. Please confirm if the specifications are acceptable to you? (Global Marketing Services, Bengaluru, India)			and agreed upon by TSC as it fulfills our planned writing requirements, and reducing it will be detrimental to our planned R&D. Writing speed requirements specified by us are generic, and these are also offered by other participating firms/OEMs in PBC as well. The importance of required writing speed and writing time can also be gauged because we have set these as the acceptance criteria.
Acceptance criteria	Acceptance criteria should be specified. (Global Marketing Services, Bengaluru, India)	Accepted	Acceptance criteria have now been specified in S. No. 18 of the final specifications as following "Fulfilment of writing speed requirements mentioned in S. No. 8"	
16. Installation requirements, technical support	More clarity is required about the type of photoresists to be supplied. (Global Marketing Services, Bengaluru, India)	Accepted	Suitable photoresist (negative/positive), developer, and remover, required to write structures fulfilling acceptance criteria during testing/installation/commissioning of the system, should be supplied.	
2. Variable Resolution, feature details, and Writing Modes: Critical dimension uniformity (CDU) / Line width uniformity (LDU): $\leq \pm 100$ nm.	Request you to please modify the above specs as CDU/LDU ≤ 200 nm (M/S HTL Co. (India) Pvt. Ltd, Bengaluru, India)	Accepted	Critical dimension uniformity (CDU) / Line width uniformity (LDU) [3σ]: ≤ 200 nm.	
4. Light source	LED & Laser both acceptable? (M/S HTL Co. (India) Pvt. Ltd, Bengaluru, India)	Accepted	No need of revision	
	Gray Scale Level? (M/S HTL Co. (India) Pvt. Ltd, Bengaluru, India)	Not applicable		Not the part of tendered specifications.
	Back Side Alignment? (M/S HTL Co. (India) Pvt. Ltd, Bengaluru, India)	Not applicable		Not the part of tendered specifications.
2. Variable Resolution, feature details, and Writing Modes: Write structures line by line.	1. Write structures line by line – We did not understand this. (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)	Not applicable		The query was addressed to the satisfaction of the firm during PBC.
3. Substrate details: Maximum substrate size to be handled: $\geq 150 \times 150$ mm ² .	Max substrate size: IS Substrate size 100x100mm ² enough or do you need 150mmx150mm (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)	Not applicable		The query was addressed to the satisfaction of the firm during PBC.

5. Exposure/Write Area: $\geq 100 \times 100 \text{mm}^2$				
4. Light source: Two automatically selectable light sources should be included with the following wavelengths: (i) $400 \pm 10 \text{ nm}$ and (ii) $375 \pm 10 \text{ nm}$	Is only one light source wavelength 405 nm (enough power to expose thick SU8 series 2000, 3000, 6000 with great quality)? Do you really need second line? (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)	Not accepted		The need for a second light source/line was explained to the firm to their satisfaction during PBC. Two light sources are required to work with broadband photoresists so that the system can be used for diverse applications.
7. Alignment accuracy, focus and camera: Automatic wafer alignment.	Automatic wafer alignment – it is never fully automatic (speaking for R&D applications, where there are always different substrates), what does this mean? (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)	Not applicable		The query was addressed to the satisfaction of the firm during PBC.
7. Alignment accuracy, focus and camera: A live image of the substrate should be visible during exposure.	Live image visible during exposure – live image of the substrate or exposure process? We do show live image of the pattern part being exposed) (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)	Accepted	No need of revision.	
8. Writing speed: $\geq 10 \text{ mm}^2/\text{minute}$ for $\leq 0.6 \mu\text{m}$ spot size. $50 \times 50 \text{mm}^2$ area should be written with 100% pixel exposure and $0.6 \mu\text{m}$ spot size in ≤ 300 minutes.	writing speed – ok, but what does it mean 100% pixel exposure and $0.6 \mu\text{m}$ spot size – where is the point there? (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)	Not applicable		The query was addressed to the satisfaction of the firm during PBC.
10. Process software: The system must process the CAD formats DXF, CIF, GDSII/GDS2, BMP (grayscale), and Gerber.	GDSII/GDS2 is not supported in the existing version, DXF, BMP, ... yes (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)	Accepted	The system must process the CAD formats like DXF, CIF, BMP (grayscale), and Gerber.	
16. Installation requirements,	Suitable photoresist, developer, and remover required to write	Not		The query was

<p>technical support: Suitable photoresist, developer, and remover, required to write structures during testing/installation /commissioning of the system, should be supplied.</p>	<p>structures during testing/installation/commissioning of the system, should be supplied.? - Do we need to quote plasma Asher also – what developer are you looking at? (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)</p>	<p>applicable</p>		<p>addressed to the satisfaction of the firm during PBC.</p>
<p>17. Previous installations: Minimum one system of the quoted model should be installed in India.</p>	<p>There is no system installed in India yet. Is this, OK? However, we have many systems supplied globally in Europe, China, and US etc. (M/S Anarghya Innovations and Technology Pvt. Ltd., Bengaluru, India)</p>	<p>Accepted</p>	<p>Minimum one system of the quoted model should be installed in India or abroad.</p>	