Tender specifications for RIE/ICP tool:

Tender Format:

The tenders are to be submitted in 3-part scheme

A) **Part A** must have the technical specifications

B) **Part B** must have the financial offers

C) **Part C** (An Earnest Money Deposit) EMD of should be provided as a Demand Draft in Favour of Registrar, IISER Mohali. Please refer to the advertisement for amount of EMD.

All parts are to be separately sealed in clearly labeled envelopes (e.g Technical Bid) and sealed and delivered in a large envelope. Please refer to the advertisement for last date and timings to submit the tender.

Part A must have the following information

A1) **Mandatory Specifications:**

All equipment must meet or exceed the mandatory technical specifications for product and services . Vendors must provide a compliance sheet for the mandatory specifications.

A2) **Customer Feedback**

- Customer feedback on actual performance and service of vendor will be solicited and used to qualify vendors (**Vendors are expected to provide references along with the tender and also in advance by e-mail to avoid delays)** . e-mail : ananthv@iisermohali.ac.in v_ananth@rocketmail.com.
- **Provide around 15-20 references world-wide and all references in India if any equipment supplied are required for RIE/ICP. Provide around 5- 10 from outside the main continent of operation (e,g if your company is in Europe give references in Asia or America , especially if you don't have systems in India.**
- IISER will also look for installations of vendors who have contacted in pre-tendering and during or after tender submission period to solicit customer feedback by phone and e-mail. All feedbacks are confidential and IISER cannot release them or quote them at any point.

A3) **Technical questionnaire & Presentation:**

A questionnaire will be used to evaluate the performance of the tool, company profile and service provided by the vendor. Vendors are also required to make a presentation with their service Engineer one week after the tender.

Evaluation scheme:

Companies considered after evaluating Part A1 and A2 will be evaluated for part A3**. In part A3 also we** may reject vendors

- if the committee is not convinced of service capability of vendor (**especially in India**)
- If the tools are extremely poor performance in comparison with what is offered by the competition.
- Not providing processes for some important materials that end users in IISER may want to etch
- IISER may also request samples to be etched and demonstrated

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For all qualifying vendors 60% weight age will be given for the scores in part A3 and 40% for part 4 the price. The vendor with the highest score will be given the order. The vendor with highest overall score will get the order.

Financial terms:

- Please give maximum breakdown in price bid to facilitate and choose options. IISER reserves the right to consider some options for future procurement with the vendor having maximum score.

- Financial terms for procurement has to be satisfactory to IISER as per Govt. of India rules.
- Any vendor not co-operative or delaying financial terms may result in rejection of the said vendor.

Clarifications:

If any points are not clear please write to Dr Ananth Venkatesan (v_ananth@rocketmail.com, ananthv@iisermohali.ac.in) . Please send details of reference customers also to both these e-mails.

PART A1 Mandatory Specifications:

General Features

G1)The system is meant to delineate small patterns produced by e-beam lithography. Both anisotropic and isotropic etches are to be performed. **Please show patterns with feature size below 50 nm with good aspect ratio .**

G2) The system is expected to be used for a wide class of materials like metals, semiconductors and ceramics to make nano/micro-electromechanical systems and submicron to micron scale superconducting or spintronic devices.

G3) Apart from anisotropic etches from few 100 nm to 2-3 microns the tools should also be capable of isotropic under-cut etches(5-6 microns) and via holes through wafers.

G4) Vendor should have sold at-least 20 systems worldwide with automatic load lock.

G5) **The vendor should specialize also in R&D** tools **and must have a process lab that provides recipes and works with customers to develop recipes (free of cost for the lifetime of the tool)** . **Vendors specializing only in fully automated turnkey tools need not quote.**

G6) Vendors must quote models that **meet or exceed the specifications** below. The quoted models must be **standard models** with more than **ten units** supplied and not re-engineered to meet the specifications. **Any exceptions to the specifications must be clearly stated (the committee will consider exceptions based on tool performance, expandability and needs of potential etch materials in future**.)

subsection		**Specifications**	**Comments**	**compliance statement and comments by manufacturer**
process conditions				
	1	Process pressure from 5 mtorr to 300 mtorr with appropriate pressure gauges to measure In these ranges.	pressure and flow control accuracy is critical in low pressure regime below 100 mtorr . Above 100 mtorr error of 5 to 10 motrris acceptable . Below 100 it should be 0.1-0.2 mtorr accuracy	

	2	Chamber base pressure must be ~10^-6 torr or lower.	after cleaning recipes system should reach 8*10^-7 torr or lower but must typically reach ~ 5 10^-6 torr in ~3-5 mins after sample change	
	3	MFCs up-to ~50 SCCM or higher MKS analog 3 for toxic gases 8 for non toxic gases including flammable gases. Gases for cleaning chamber (O2, SF6 or CF4) must have MFCs upto 100 SCCM or above		
	4	**RF power supply for RIE /DC** bias 600 W at 13.56 MHz controllable from **10W to 600W** with 1 W or lower resolution		
	5	**RF power supply for ICP** Around **~ 1.2 Kw** or with range from 10 W to full range.	please give performance details for different powers if you are quoting models of different powers.	
	6	option for RIE, RIE+ICP and only ICP with RIE only for plasma strike		
	7	option to measure DC bias with graphite plate for fluorine processes	must measure reflected power for chlorine processes using quartz plate	
	8	RIE /ICP must be homogenous over a central area of **50 mm** dia or more with in-homogeneity <5%		
	9	plasma density of> 10^11 ions/ cm^3 with ionization energy 10eV or more.	**Please give test reports.**	
	10	high pressure strike mode for low pressure etch modes		
Chamber				
	11	must be Machined from a Single Aluminium Block		
	12	Front View ports (sapphire or quartz) for viewing plasma with UV shielded grid		

	13	view port for UV spectroscopy (sapphire or quartz)		
	14	view port on top (sapphire or quartz) at centre of reactor for laser interferometer		
	15	automatic Isolation valve between process-chamber and wafer load-lock		
	16	Al2O3 or quartz chamber for separating ICP coil	Al2O3 or quartz cover plate in case of planar ICP coil designs.	
	17	Electrical Chamber wall heating to around T ~80C to prevent contamination.		
	18	Hydraulic lift mechanism to open chamber lid for cleaning/servicing or changing reactor plates.		
load lock				
	19	must have a magneto-Pneumatic valve with an **automatic robot arm for transfer**	manual wobble sticks manipulators etc will not be accepted.	
	20	Must have graphite sample holder for fluorocarbons , quartz sample holder for chlorinated recipes. **In non-platen geometry a quartz and graphite holder for small pieces must by supplied.**	Reactor plate must be interchangeable between graphite and quartz plates.	
	21	Gate valve opening and chamber must be able to accommodate wafers up-to 10mm thick.		
	22	Load lock must have large transparent window to view samples.		
Temperature control				
	23	Helium back flow cooling		
	24	process heater chiller with control from 0 deg C to 85 deg C or above		

Pumping system	**25**	Around 1000 l/s or higher turbo with **magnetically levitated bearing** appropriate to handle corrosive chlorinated gases. (**Please give cost of pumping systems separately in financial bid) Any chiller required for pumps must also be provided.** **Include chiller for turbo in quote.**	equivalent of Adixen/Pfieffer or Edwards. If you have tie-up with another pump vendor please confirm service possibility in India.	
	26	turbo must be placed symmetrically to give homogenous pumping		
	27	A T-piece must be used to avoid direct suction of sample pieces into turbo and also have a mesh to prevent samples pieces falling in	Please indicate alternate measures if used to avoid sample suction.	
	28	Fomblin based **hermetically** sealed backing pump with a pumping speed around **40 m^3/h** or better must be located remotely. System must have N2 purge option with appropriate filters and cartridges to handle specified gases.	quote option for hermetically sealed dry pump compatible with chlorine separately in financial bid.	
	29	heated pumping lines and valves		
	30	load lock pump must be dry Adixen ACP 15 or equivalent 12m3/h dry pump(scrolls and wet pumps are not preferred) must be located remotely or within system.		
gas distribution				
	31	A gas pod that can be located remotely with 12 gas lines and MKS or equivalent mass flow controllers Non toxic gases Ar, O2, CF4, CHF3, SF6 non-toxic flammable gases H2, CH4, C2H6 (ethylene) Toxic and corrosive gases SiCl4 , Cl2 and BCl3. The 12th line must have a by-pass option and blanked for future use.	If you have models with more than 12 pods quote without MFCs for these as a separate option.	
	32	Bypass of MFC must be provided for corrosive gases		

Interface	**33**	Computerized **interface with stand alone PC without touch screens** (for ease of replacement) must be included.		
	34	Windows 7/8 or Linux based system		
	35	Automatic and manual process control		
	36	All data like pressure, impedance matching parameters, bias voltage , reflected power , sample holder temperature must be displayed live as a graph with different colours/symbols with proper scale and must be automatically logged and archived for future reference.		
	37	must support multiple processes(at-least up-to 12) in sequence		
	38	Automatic tuning of RF matching network from process software		
	39	Option for manual diagnostics and adjusting matching network manually from software for fine tuning of process.		
	40	User accounts that limit process modification for novice users and full flexibility for advanced users.		
	41	Remote access of tool from manufacturer's site to make diagnostics and provide service advise.		
Spares and supplies	**42**	**Vendor must guarantee spares , supplies including computers and software are replaceable for 15 years or more.**		
	43	**Two tubes of Fomblin grease for mounting samples**		
	44	**Regular consumables like pump oil, o-rings (load lock and other areas) must be provided with spares . Any special non-standard tools for maintenance or running must be provided.**		
Additional tools	**45**	quote laser interferometer based etch monitor as an extra option		
	46	Quote UV spectrometer as an extra		

		option		
	47	If your system has any other additional non-standard features or tools quote them as an option.		
Warranty	**48**	Tool must have complete warranty for 3 years with a 9 % total performance Bank guarantee. The performance bank guarantee will be returned as 3.0% annually.		
Power requirements	**49**	All equipment and accessories like chillers must draw supply from 50 Hz 3-phase supply at 415 V or 220 V single phase at 50 Hz. **Any power adapter should come within the specified layout.**	Please give current rating required and typical consumption. Please provide starting current requirements for estimating UPS ratings	
Layout	**50**	The entire system must be accommodated within the layout specified (**Attached to last page of document) All tubing , electrical lines, vacuum bellows must meet the layout.** **The system must be a standard model cited in the vendor's website /brochure . Custom models with re-engineering to meet the layout will not be accepted.**	Please provide compliance with a sketch . (CAD versions available on request.)	
Installation & service	**51**	**The vendor must have a local service engineer with sound experience in servicing /installing RIE/ICP systems.**	IISER will call the service Engineer for a presentation on tool operation service issues and safety.	
	52	The installation must be done in 3-4 weeks after tool delivery along **with training** and safety routines for users from IISER .		
	53	The installation and service also involves collaborating with third party systems for gas handling and distribution		
Safety	**54**	System should have emergency shutdown option	Preferably integrated with auto-shutdown of gas supply .	

	55	Emergency interlocks with automatic and manual shutdown in case of leaks in reactor must be provided.		

Part A2 Technical Questionnaire:

General information (no specific points given)

a) Please give all power requirements including starting currents and total power and current rating for helping us decide on appropriate UPS.

b) Please list all utilities required for the system other than power.

c) please indicate any major takeover , merger or bankruptcy your company may have undergone in last 10 years. give a brief statistics of sales record

d) Kindly indicate how you learnt about this tender

i) Newspaper advertisement ii) IISER Mohali web page (iiii) e-mail informing about advert from IISER Faculty .

iv) e-portal (v) other sources

1) Is your gas pod expandable beyond 12 gases for future usage (**10 points for maximum expandability**)

2) Please give etch recipes for the items listed in the table.

- **Please cite/provide publications or customer reference for process and or data from process lab SEM pictures of etched surfaces**
- The surfaces with less damage , minimal micro-masking with will be given points based on etch rates , selectivity as found optimal for end users in IISER.
- **Not providing recipes for a certain material or a class of material may result in disqualifying the system.**
- **Under performance in comparison with competing vendors in certain materials may also result in disqualification**.
- All quoted etch rates must be from proposed model of tool .
- **Please give ICP/RIE and RIE processes**.
- Please confirm if the process can be done with the specified gases and if any extra gases will be needed.
- **Also provide ICP and RIE power for each recipe even if full details like flow rates and pressure are not given.**
  (90 points for reminder) The total score will be scaled to 60 maximum.

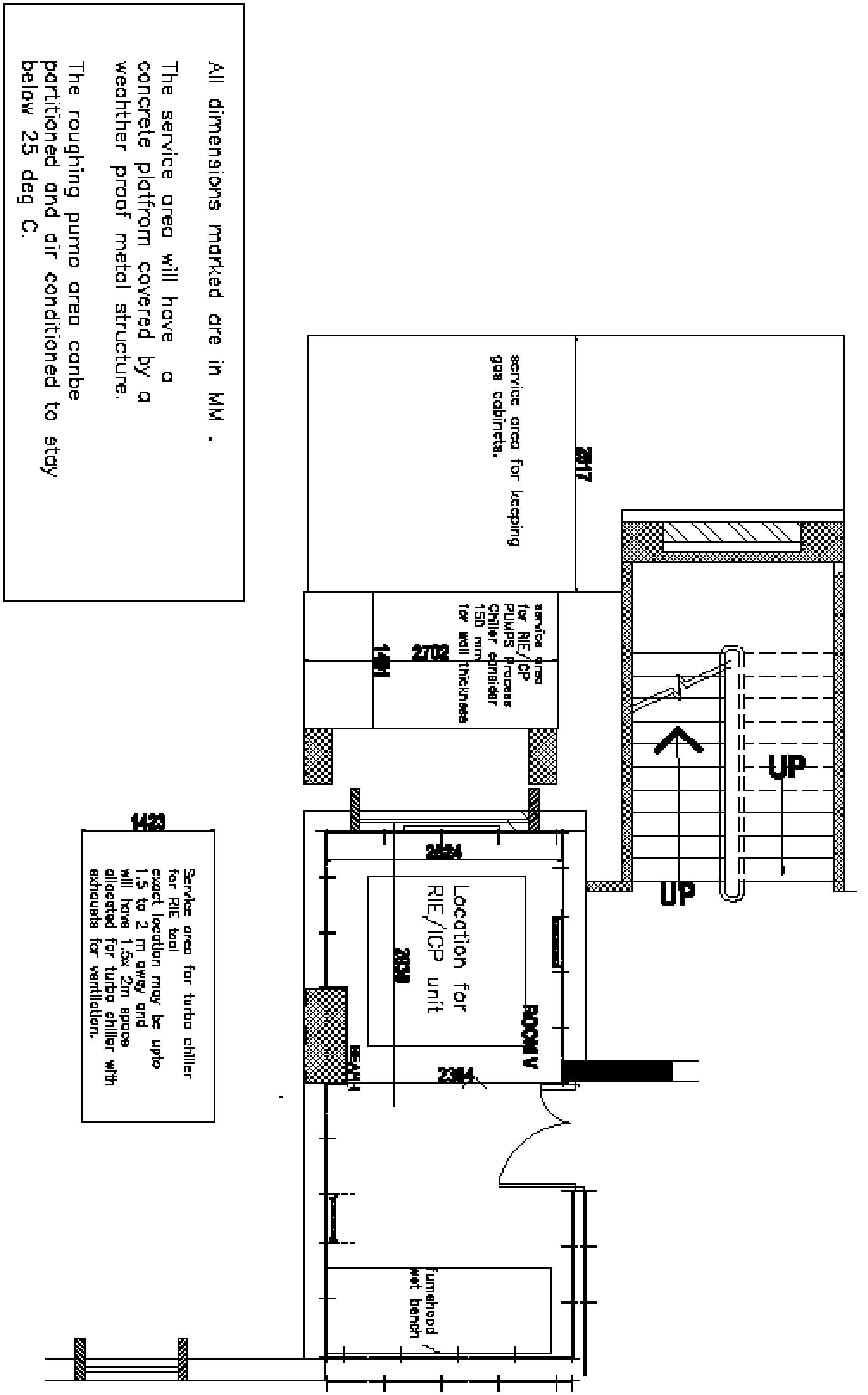
IISER will reserve the rights to send test samples at any point to clarify performance or may reject vendors if some etch rates are not well documented.

Etch recipes

	S No	Etch Profiles			Comments
		Material			
Compound Semiconductors	1	GaAs	Anisotropic	Via holes	Show selectivity of AlGaAs over GaAs for etch stop
	2	AlGaAs	Anisotropic	Isotropic	Show low damage and fast recipes
	3	InP	Anisotropic		
	4	GaN/AlGaN	Anisotropic		
Ceramics	5	PZT	Anisotropic		Please give alternate masks and their selectivity also. If isotropic etches are possible for ceramics cite them also
	6	LiNbO3	Anisotropic		
	7	SrTiO3	Anisotropic		
	8	Sapphire	Anisotropic	via holes	
Silicon based	9	Silicon	Anisotropic	Isotropic/via holes	
Compounds	10	SiO2	Anisotropic	Isotropic	
	11	Silicon Nitride	Anisotropic	Isotropic	
	12	silicon carbide	Anisotropic		
Metals	13	Niobium	Anisotropic		
	14	Aluminium	Anisotropic		

	15	Gold	Anisotropic		

Site Layout



All dimensions marked are in MM .
The service area will have a concrete platfrom covered by a weahther proof metal structure.
The roughing pumo area canbe partitioned and air conditioned to stay below 25 deg C.
service area for keeping gas cabinets.
service area for RIE/ICP PUMPS Process Chiller consider 150 mm for wall thickness
UP
UP
Location for RIE/ICP unit
ROOM V
Service area for turbo chiller for RIE tool exact location may be upto 1.5 to 2 m away and will have 1.5x 2m space allocated for turbo chiller with exhausts for ventilation.
fumehood / wet bench