

# Price list NorFab

The vision of NorFab is to be a robust and competent backbone consortium supporting and enabling research and innovation within micro-and nanotechnology (MNT) in Norway. NorFab will be an enabling resource for both academic and industrial R&D.

The members of the NorFab consortium are NTNU NanoLab, UiO MiNaLab, SINTEF MiNaLab and USN MSTLab. More information about the national infrastructure NorFab can be found at [www.norfab.no](http://www.norfab.no).

This document introduces the price systems for the NorFab laboratories. In general, the three university cleanrooms are hands-on and open-access, meaning that the users will carry out the research themselves after an initial training process. However, for some instruments an operator is required.

SINTEF MiNaLab has an ISO-certified semi-production line with strong requirements regarding access and cleanliness. Therefore, the infrastructure requires an operator for all processing carried out in the lab and the prices follow a different system than for the university NorFab nodes.

The presented prices are based on the intention to share the costs of the infrastructure among users. Prices for academic activities are subsidised through basic funding from the universities and the Research Council of Norway. Prices for industrial activities are based on a full-cost approach; no cross-subsidies between the user groups are given.

## User categories

NorFab distinguishes between academic, start-up and industry activities that use the infrastructure. The corresponding users are defined in Table 1.

Table 1: the defined user categories within NorFab.

Academic users	Users from start-up companies	Industrial users
<ul style="list-style-type: none"> <li>• Bachelor, Master and PhD students</li> <li>• Post docs/researchers</li> <li>• Fully internally-financed research within non-profit research institutes</li> <li>• Publicly funded and co-funded projects (i.e., NFR, EU).</li> </ul>	<ul style="list-style-type: none"> <li>• Companies following the EU definition of micro enterprises</li> <li>• Research projects financed by start-up companies</li> </ul>	<ul style="list-style-type: none"> <li>• Any other company/user</li> <li>• Research projects fully financed by industry</li> </ul>

Academic activities are considered as knowledge building with a pronounced aim to contribute to the general scientific knowledge base. There is therefore a strong ambition that processes developed during the course of academic activities will be documented and to a large extent made available to NorFab.

## Prices

NorFab's price structure is based on the costs for use of the infrastructure and is divided into four parts:

- Instrument costs, paid per booked hour for more expensive instruments with running costs >100 NOK/hour
- Operator costs, paid per hour of use of personnel for operating machines

### General rules for flat rates

Flat rates are based on average cost estimations and the purpose of flat rate is to facilitate project planning. The following rules apply:

- PhD students are charged for a maximum of 3 years
- Instrument booking rules apply
- No operator service included

### Other conditions

The following conditions apply:

- Users of the institute sector are charged after the following rules:
  - all publicly funded and co-funded projects (ie NFR, EU) academia
  - projects fully financed by industry industry/start-up
  - internal projects\* academia

*\*Requires project and budget description accepted by the institute management and access to cleanroom process descriptions.*

- Training costs (to become a user) are currently covered by NorFab, for any user involved in a proposed activity in NorFab.
- To enable easy calculation of prices for long-term use of the infrastructure, NorFab also offers flat rates, with full use of the university cleanrooms within the infrastructures on a monthly, semester, or yearly basis. Flat rates are only available for *academic users*.
- Furthermore, NorFab offers both opportunities and space for own instruments and more permanent set-ups. To utilise this and evaluate possibilities please contact NorFab for further discussions.

**Tasks performed by operator**

The following operator prices are charges in addition to the fees given above:

*NFR/EU projects*

SINTEF*	based on SINTEF hourly rates depending on operator qualification and project type
Universities	750 NOK/h

*Start-up/Industry projects*

SINTEF*	based on SINTEF hourly rates depending on operator qualification and project type
Universities	1100 NOK/h

UiO MiNaLab has limited capacity for operator services. NTNU NanoLab and USN MST-Lab offers some operator services on hourly rates.

All prices are given exclusive VAT.

**Prices list UiO MiNaLab and USN MST-Lab**

Table 2: Price list of NorFab nodes UiO MiNaLab and USN MST-lab. Prices pr hour are in NOK, excl. VAT.

	<b>Academia</b>	<b>Start-up</b>	<b>Industry</b>
<i>Instrument prices (a list of available equipment and pricing is given in appendix 1)</i>			
Instrument type A (/h)	100	125	150
Instrument type B (/h)	300	375	450
Instrument type C (/h)	500	625	750
Instrument type D (/h)	800	1000	1200
Instrument type E (/h)	1000	1250	1500
Instrument type F (/h)	1250	1580	1900

The reduced fees for start-up companies are available for the first 24 months after start-up.

Table 3: Flat rate prices of NorFab nodes UiO MiNaLab and USN MST-lab (in NOK)

	<b>UiO MiNaLab</b>	<b>USN MST-lab</b>
Flat rate / full infrastructure (free use of the entire NorFab infrastructure) *	150.000 / year	125.000 / year
Training costs	0	0

*\*The flat rates are only available for academic users (as described in User categories). The flat rates do not include operator services.*

The prices listed below may vary for users originating from UiO and USN due to local subsidies given by NorFab partners to their employees. For information regarding local subsidises, contact your local laboratory.

## List of instruments

UiO MiNaLab			
Warm cabinet		Thermal Processes	A
4-point probe	Jandel KM3-AR	Characterization	A
Ellipsometer	Woolam AlphaSE	Characterization	A
Stylus profilometer	Veeco Dektak 8/DektakXT-A	Characterization	B
CV/IV characterization; probe station	Agilent 4284A, Keithley 617, Keithley 2440	Characterization	A
Solar simulator	Newport 91160 Full Spectrum Solar Simulator	Characterization	B
Wet etch	Manual wet station	Etching, dry and wet	B
Spectrophotometer	Shimadzu SolidSpe-3700 DUV	Characterization	C
Hall/TDH	LakeShore EM4 HGA	Characterization	C
FTIR	Bruker IFS 125HR	Characterization	C
Photolithography	Table-top Heidelberg + wet etch + spinner	Lithography	B
High temp tube furnace	Gero 1 75242/ Gero 2	Thermal Processes	B
Tube furnace	Lindberg 59544/ Birkeland GSL1100X	Thermal Processes	B
Thermal evaporation	Balzers BAE 250	Deposition	B
E-beam evaporation	Angstrom PVD	Deposition	C
XRD	Bruker AXS D8 Discover	Characterization	C
Rapid Thermal Processing	AnnealSys AS-Micro/ AnnealSys AS-One	Thermal Processes	C
Magnetron sputtering	Moorfield MiniLab/ Moorfield NanoPVD / Semicore TriAxis	Deposition	C
Flextura cluster	Magnetron sputtering / in-situ annealing / LEED / XPS / UPS / ARPES	Deposition/Charac terization	D
PECVD	Advanced Vacuum Vision 310 MK II	Deposition	D
RIE	Advanced Vacuum Vision 320 MK II	Etching, dry and wet	C
Doping – Ion Implantation	NEC Tandem accelerator	Other	D*
ALD	Beneq TFS 200- 148	Deposition	E*
Optical Microscope	Olympus BX 41 M	Other	incl.
RBS		Characterization	D*
Cross Section Polisher	Jeol IB-19520CCP	Characterization	A
Scanning Electron Microscope	Jeol IT-300	Characterization	C
Scanning Probe Microscope	Nanonics MV2000	Surface analysis & TEM	C

MST	MSTLab USN			
MST101	Thermal cycling	Weiss- Weiss Technik 64	Characterization	A
MST102	Interferometer	Veeco - Wyko NT9100	Characterization	A
MST103	IR camera	PL-B741E 1.3MP monochrome camera	Characterization	incl.
MST104	Microscopes	Leica - DM 4000M Carl Zeiss Jena Neophot 32	Characterization	incl.
MST106	Probe station	PWS - Probe II	Characterization	A
MST107	Profilometer	Veeco- Dektak 150 Stylus ProfilerScan	Characterization	B
MST109	Shear tester	F&K- Delvotec 5600	Characterization	A
MST201	Tube furnace (Oxidation) Oven	HarmbridgeHitech Furnace	Thermal Processes	A
MST301	Student photolithography	Karl Suss: MA56	Lithography	B
MST302	Photolithography	EVG -AL6 / 620	Lithography	C
MST303	Plasma cleaner	March Plasmod	Lithography	incl.
MST305	UV Cleaner	UVOCS (Ultra-Violet Ozone Cleaning System)	Lithography	incl.
MST401	Au sputter	Fison Instruments Polaron SC500	Deposition	incl.
MST402	Electroplating (wafer and pieces)	Heimerle + Meule - PGG 20	Deposition	C
MST403	Thermal evaporator	MiniLab T25M	Deposition	C
MST501	RIE	PlasmaTherm - SLR series	Etching, dry and wet	B
MST502	Wet Etching	General wet-benches	Etching, dry and wet	B
MST602	Wafer bonding (Anodic, Fusion and Metallic)	EVG 501 Wafer bonder EVG 620 Bond aligner	Wafer bonding	B
MST701	Die attach	Laurier Incorporated	Packaging	A
MST702	Flip-chip bonder	MAT- MAT 6400	Packaging	B
MST703	Dicing SI-wafer	Disco- DAD-2H/6T	Packaging	A
MST703	Dicing ceramik ++	Disco- DAD-2H/6T	Packaging	B
MST704	Wirebonder	F&K- Delvotec 5610	Packaging	A

\*operator required

## Price list NTNU NanoLab

*The price system of NTNU NanoLab follows the Norwegian Research Infrastructure Resource (RIR) model 1. The following document describes the new price system and introduces the payment policy for all user groups.*

### ***User categories***

The price system distinguishes between academic and industry activities that use the infrastructure:

*Academic users* are defined as:

- Bachelor and master students
- All research projects where NTNU is a partner (“bidragsprosjekt”)

*Industrial users* are defined as:

- All research projects where NTNU is not a partner (“oppdragsprosjekt”)
- All commercial companies/users (including start-up companies)

*Academic activities* are considered as knowledge building with a pronounced aim to contribute to the general scientific knowledge base. It is, thus, a strong ambition that processes developed during the course of academic activities are documented and to a large extent, made available to all users of the NorFab infrastructure.

The definition of the user groups is subject to change and this document will be updated accordingly. If you have questions, please contact the NanoLab administration.

### *Price system*

NTNU NanoLab charges two categories of hourly prices for working in the cleanroom:

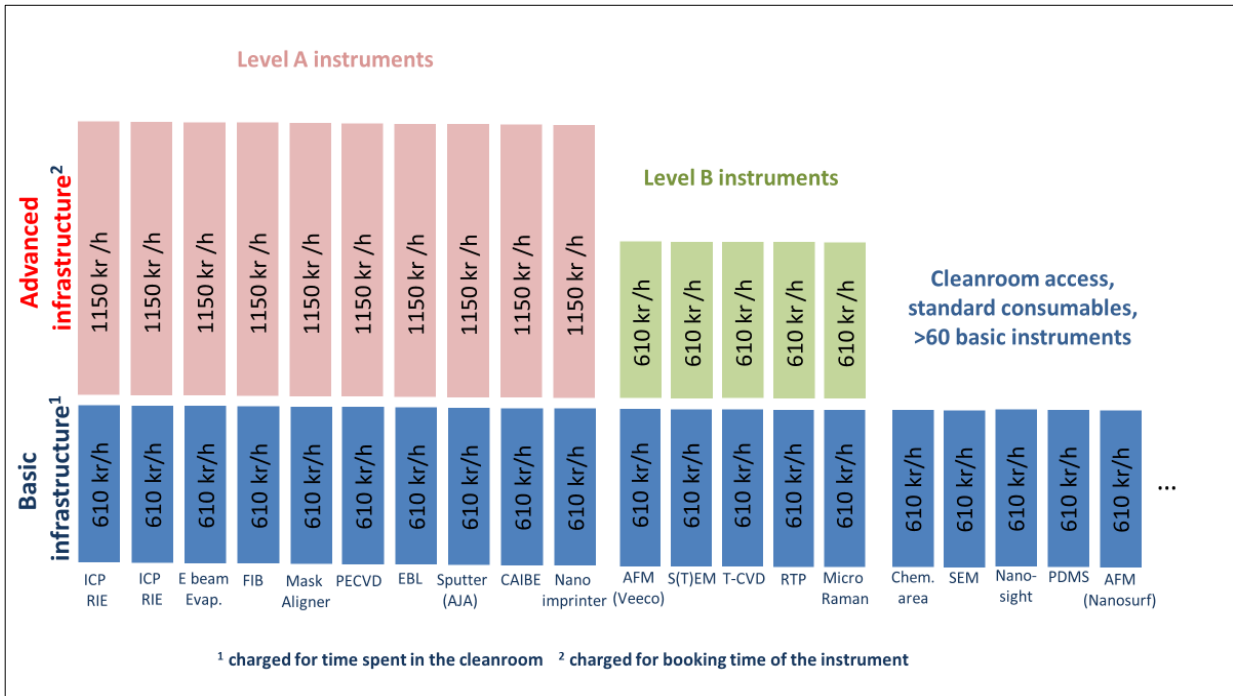
1. ***Basic Infrastructure rate*** (charged for access time in the cleanroom)  
This fee covers the use of the basic cleanroom infrastructure. It includes more than 60 smaller instruments, standard chemicals and targets. The fee is charged for the time the user is accessing the cleanroom.
2. ***Advanced Infrastructure rate*** (charged per booked instrument hour)  
This fee covers the running costs for advanced tools. The tools are divided into two groups. The fee is charged for booked instrument time.

A user working in the cleanroom, using an instrument of the advanced infrastructure pays both the basic and the advanced infrastructure rate.

<sup>1</sup> [http://www.uhr.no/documents/A\\_Norwegian\\_Research\\_Infrastructure\\_Resource\\_Model\\_270214.pdf](http://www.uhr.no/documents/A_Norwegian_Research_Infrastructure_Resource_Model_270214.pdf)

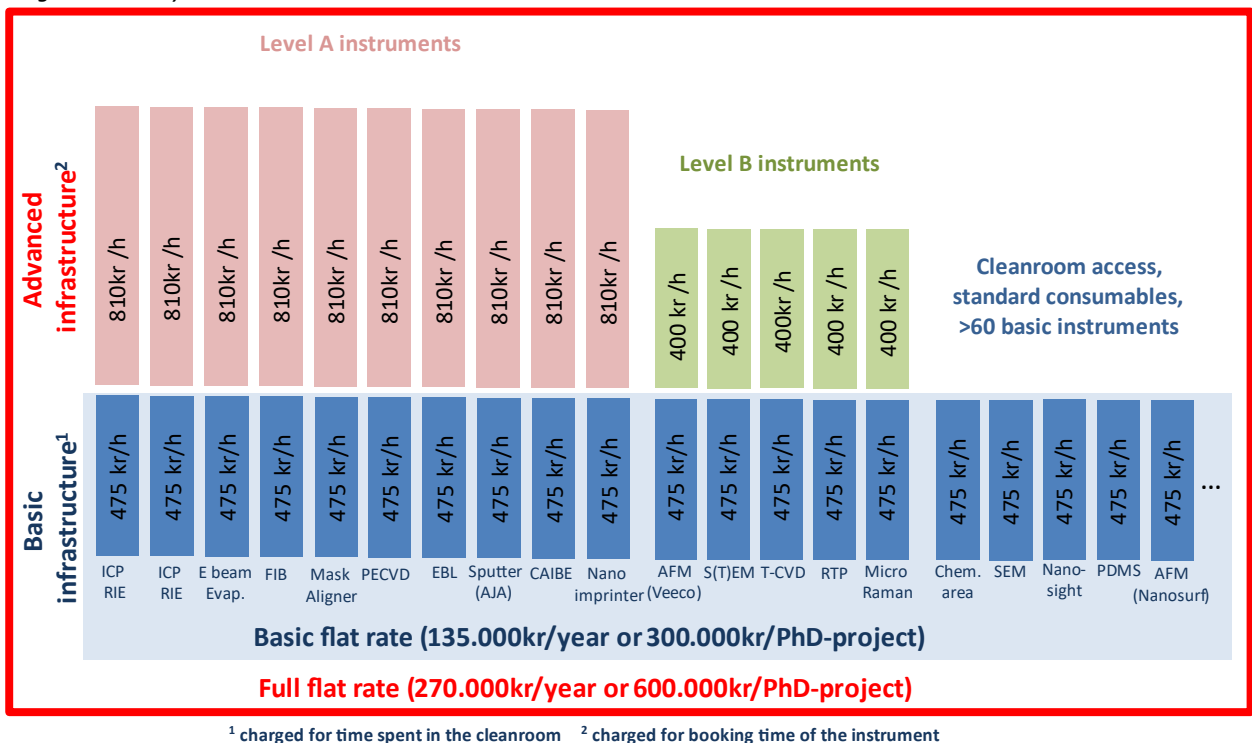
Industrial users: Figure 1 gives an overview of NTNU NanoLab’s price system for industrial users. For this user group only hourly prices apply.

Figure 1 Price system industrial users



Academic users: Figure 2 shows the price system for academic users. Academic users can either choose to pay per hour, or buy one of our flat rate arrangements.

Figure 2 Price system academic users





Level A	Level B
AJA Sputter and Evaporator	AFM, Veeco
E-Beam Evaporator	T-CVD
Electron Beam Lithography	Micro Raman
FIB	Rapid Thermal Processing (RTP)
ICP-RIE Chiller	S(T)EM
ICP-RIE Cryo	
Maskaligner MA6/EVG620	
Nanoimprinter SCIL/EVG620	
PECVD	
CAIBE	

Figure 3 Instruments in the 2 different price levels

An overview of all instruments can be found on LIMS ([ntnu.norfab.no](https://ntnu.norfab.no)) and the NorFab homepage ([www.norfab.no](https://www.norfab.no)).

### Flat rate

Flat rates give academic users the possibility to cover cleanroom costs using an easy-to-plan and easy-to-use approach. A flat rate agreement can be signed per year or for a whole PhD-project.

Two categories of flat rates are available:

1. **Basic flat rate** covers use of the basic infrastructure, including cleanroom access, standard chemicals and small instruments. Instruments defined as advanced infrastructure have to be booked and paid separately by the hour.
2. **Full flat rate** covers use of both basic and advanced infrastructure. A full flat rate agreement is valid in the entire NorFab infrastructure.

### Payment policy

Figure 2 shows the payment policy for the different user groups at NTNU NanoLab.

Master students	Student/ PhD Courses	Internal financed PhD students/ Post.docs (SO/RD)	External financed PhD students/ Post.docs (i.e. NFR, EU)	External financed PhD students/ Post.docs without funding*	External academic users*	Industry users
NTNU 100%	NTNU 100%	NTNU/ NorFab 90%	Project funding 100%	NorFab 90%	NorFab 100%	Project funding 100%
		Own contribution 10%		Own contribution 10%		

\* application for NorFab support need to be submitted and approved

Figure 2 Payment policy for NTNU NanoLab users

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*NTNU NanoLab MUST be acknowledged in all publications based on the work in the facility and the publications are to be sent to nanolab@ntnu.no. All academic users receiving support from NorFab MUST acknowledge this support in all publications (the following phrase should be used for this purpose: "The Research Council of Norway is acknowledged for the support to the Norwegian Micro- and Nano-Fabrication Facility, NorFab")*

### **Users with NTNU affiliation**

For NTNU-affiliated users some local regulations apply for the use of NTNU NanoLab:

- *Project / Master students*  
Project and master students may use the infrastructure for free within the scope of their study program. The cost for their use is covered by NTNU.
- *PhD-students /postdocsfinanced by external funding sources*  
These users are expected to apply for external funding of the cleanroom fees. If the external funding is rejected, these users can apply for NorFab support. With NorFab support, an own contribution of 10% of the standard rates will be charged. This rule applies also for flat rates.
- *PhD-students/post docsfinanced by NTNU*  
The fee for these users is covered by NTNU and the Research Council of Norway through NorFab. The users pay an own contribution of 10% of the standard rates. This rule applies also for flat rates.
- *Projectswith call deadline before 01.04.2015*  
These projects can use the infrastructure at the appointed flat rates valid at the moment of application. The price difference is covered by NorFab. Please contact the NanoLab administration for more information.
- *Supervisors/co-advisors*  
Supervisors/co-advisors of students (PhD or master) can enter the cleanroom for free together with the student. However, the status as supervisor/co-advisor must be made clear in the activity document and he/she is not allowed to carry out other work in the cleanroom.
- *Pre-project activities*  
Short pre-investigations in NTNU NanoLab (up to 4 hours in total) can be carried out by NTNU NanoLabs staff or by an appointed user of the infrastructure free of charge. Please contact the NanoLab administration for this.

If you have any questions regarding the price system or problems to finance your cleanroom work, please contact NTNU NanoLab (nanolab@ntnu.no) to resolve how your activity should be charged.

**External academic users**

External academic users will be charged as industrial users if they are not part of a project with NTNU as partner. However, these users can apply NorFab (NorFab support<sup>2</sup>) for covering the full cleanroom fees. Unfortunately, we are not able to pay travel and accommodation costs for these users.

**Operator services**

NTNU NanoLab has limited capacity for operator services. Please contact the NanoLab administration [nanolab@ntnu.no](mailto:nanolab@ntnu.no) to inquire about availability and prices. Operator services are charged by hourly rates and come in addition to the instrument and basic fees.

The price system including the prices given in this document will be enforced from 01.07.2015 and subjected to annual revision. All prices are given exclusive VAT.

<sup>2</sup> <http://www.norfab.no/access-and-support/>

## Price list SINTEF MiNaLab

The price list applies only to single processes at SINTEF MiNaLab and cannot be used to price projects including integrated processes. The indicated prices are exclusive operator cost. Activities at SINTEF MiNaLab will be performed by SINTEFs operators. For any binding quotation please contact SINTEF MiNaLab at norfab-minalab@sintef.no as most of the indicated prices are volume sensitive and as some processes might require pre- and/or post processes. Please observe that most of the equipment includes automatic or semi-automatic wafer handling, and as such yields a more industry-compatible process and capacity.

The price groups used at SINTEF MiNaLab refer to the prices listed in the "industry" column of the price matrix and will be used independently of user types and project types. User types and projects will, however, be reflected in the operators hourly rates.

### Price list for process steps at SINTEF MiNaLab

	Process step	Equipment type	Price group
SI 001	<b>Lithography</b>		<b>E</b>
	Priming, coating, aligning, baking		
	Primer	YES	
	Resist Coater	Suss ACS 200	
	Resist Coater	ATMsse Maximus 804	
	Mask Aligner (two)	Suss MA 150e	
	Baking Chamber	Different brands	
SI 002	<b>ICP-equipment</b>		<b>F</b>
	RIE, PECVD		
	Reactive Ion Etch	Alcatel AMS 200 SE I-speeder	
	Reactive Ion Etch, non-silicon etching	Alcatel AMS 200 SE I-speeder	
	Reactive Ion Etch, electrostatic chuck	Alcatel AMS 200 SE I-Productivity	
	PECVD deposition	Alcatel AMS 200 PECVD	
SI 003	<b>Wafer bonding line</b>		<b>B</b>
	wafer stack aligning, bonding		
	Bond Aligner	Suss Microsystems MA6/BA6	
	Wafer Bonder	Suss Microsystems SB6e	
SI 004	<b>Thin Film (ex. material costs)</b>		<b>C</b>
	Al. + noble metals sputtering		
	<u>Sputter for Al, Ti, TiN and W</u>	MRC 643	
	Sputter for Au, NiCr, TiW and Al	MRC 603	
SI 005	<b>Surface Characterization</b>		<b>B</b>
	SEM, Zygo, EDX		
	SEM, Scanning Electron Microscope	FEI Quanta FEG 600 with EDAX	

## NorFab

	Process step	Equipment type	Price group
	Interferometer (white light)	Zygo NewView 6300	
	Energy Dispersive X-ray analysis (EDX)	EDAX	
SI 006	<b>Electrical Characterisation</b>		<b>C</b>
	Automatic probing		
	Automatic probing station (two)	ACCRETECH TSK A-PM-90A	
SI 007	<b>Wet processing</b>		<b>B</b>
	Wet chemistry		
	Manual etching of Si, SiO <sub>2</sub> and Al	Stangl wet benches	
	Manual RCA cleaning	Stangl wet benches	
SI 008	<b>Gold process line</b>		<b>D</b>
	priming, coating, aligning, baking		
	Primer	YES	
	Resist Coater	Suss Gyrset RC8	
	Mask Aligner	Suss MA 150 KWS	
	Baking Chamber	Different brands	
SI 009	<b>TMAH, KOH (etching), RCA cleaning</b>		<b>C</b>
	Manual wet benches for etch and clean	Stangl wet benches	
SI 010	<b>Packaging</b>		<b>B</b>
	Wafer dicing	Disco DAD 321 wafer saw	
	Post dicing cleaning	Disco DSC 141 spin rince dryer	
	Wire bonding	Kulicke & Soffa 4522	
SI 011	<b>RTP</b>	Annealsys AS-Master 2000 RTP	<b>B</b>
SI 012	<b>Thermal processes</b>		
SI 013	Standard diffusion tubes		<b>A</b>
SI 014	Boron and phosphorous deposition tubes		<b>B</b>
SI 015	SiC high temperature tube		<b>B</b>
SI 016	Poly-Si and Silicon nitride LPCVD tubes		<b>4615 kr /time*</b>

\*Price exclusive VAT