

NanoLab Manual



Mercury System

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1.0 System Purpose

Mercury is the NanoLab management system that provides an efficient way to operate and monitor the laboratory resources, and support safety and stability of the cleanroom.

NanoLab staff use *Mercury System* mainly to control and manage the laboratory resources, to monitor equipment status and its usage, to monitor equipment utilities status (i.e. water, gases and power), and to prepare charges for NanoLab members in accordance with their usage of the laboratory resources.

Students and associated researches use *Mercury System* mostly to have access to the laboratory and its resources, to take qualifications tests, to interact with other NanoLab members and staff, and to file job requests or suggestions to the laboratory staff.

2.0 System Overview

Mercury System is a complex of control systems, software applications, and Windows®, UNIX[™] terminals. Its applications designed for NanoLab members are *Mercury Client* and *MercuryWeb*.

Mercury Client starts the laboratory session and gives members an ability to enable/disable equipment. It shows who is in the cleanroom at the current moment and warns if there is nobody or less than three people in the lab when a member tries to log in/out the laboratory. Also in *Mercury Client*, members may view the laboratory equipment and its status, view equipment reservations, find manuals and members who are qualified to work on the equipment, find the appropriate equipment engineers, track or file equipment problems, view the laboratory fees on materials, chemicals and equipment usage, view general laboratory fees, and review the current laboratory charges. Members have access to *Mercury Client* only from the cleanroom and only from the cleanroom Windows® terminals.

MercuryWeb provides online access to the laboratory resources via Internet browser from any place. It provides members with abilities to make equipment reservations, to view the current reservation schedule, to find and communicate with other NanoLab members, to file Mask job requests, Machine Shop job requests or ASML job requests, and to file suggestions to the laboratory staff. Like *Mercury Client, MercuryWeb* also allows one to view the current laboratory charges, to view equipment status and the laboratory supplies (i.e. materials and chemicals), to find equipment manuals, qualified members or appropriate equipment engineers, and to track problem reports for laboratory resources. Members may find the link to *MercuryWeb* at the NanoLab web site or at *Mercury Client*.

After a new member submits their NanoLab Membership form, their NanoLab member account will be created. This account provides members with an e-mail address *<login@silicon.eecs.berkeley.edu>* and with access to Windows®, UNIX[™] terminals, and to *Mercury Client* and *MercuryWeb*.

Common and Personal Environment (CAPE) is a NanoLab member's Windows® terminal from where they can login to the *Mercury Client* application. Access to *CAPE* terminals is possible only from the cleanroom computers. UNIX[™] accounts are created for access to servers: *silicon2.eecs.berkeley.edu* and *mercury4.banatao.berkeley.edu*. NanoLab members may access UNIX[™] terminals from any place via Secure-Shell connection protocol.

3.0 Applicable Documents

- Mercury System Report: <u>http://www.eecs.berkeley.edu/Pubs/TechRpts/2014/EECS-2014-149.pdf</u>
- Equipment Qualification: <u>https://nanolab.berkeley.edu/member/qualification/eqqual.shtml</u>
- Equipment Reservation Policy: <u>https://nanolab.berkeley.edu/member/reservation/policies.shtml</u>

- Tanner L-Edit: <u>https://nanolab.berkeley.edu/member/computers/computeruse/apphelp/tanner.shtml</u>
- CAD Conversion: <u>https://nanolab.berkeley.edu/member/computers/computeruse/apphelp/cad.shtml</u>

4.0 System Procedures

4.1 Laboratory Qualifications

NanoLab members must pass the safety test to gain access to the cleanroom and must qualify for each piece of equipment they use. To take a test online, members have to come in the NanoLab office, 520 Sutardja Dai Hall, and login to *MercuryWeb*. Usage of any external resources during a test is prohibited.

4.1.1 Laboratory Safety Test

Before a member passes the NanoLab safety test, their account stays in **pending** status and they will be unable to use *Mercury Client* or *MercuryWeb*.

To take the NanoLab safety test, a member needs to login to <u>MercuryWeb</u> using their login and password pair (chosen by the member on their New Member Form), and choose a facility.

Marvell Nanofabrication University of California	Laboratory a, Berkeley 406	uild(20160128)
Please select Facility	T NANOLAB CORYHALL	
Start Test	Cancel	

Figure 1. The laboratory safety test page

If a member tries to take a test from any other location except the NanoLab office, they will see the following error message:

You may take Lab Orientation Safety Test only from terminal located in SDH520.

If a member fails the safety test, they may retake it in 2 hours. If the member fails the safety test a second time, they must review the test with the NanoLab Director or a super user.

After a member passes the safety test, their account will be **activated**. This qualification lasts 1 year, and after it expires a member will be required to pass the safety quiz. Members will be notified about the qualification expiration in 30 days prior to expiration by a message from *MercuryWeb*.

Active members may use Mercury Client and MercuryWeb resources, but to be able to use and enable/disable equipment, members will need to take and pass the equipment qualification test.

4.1.2 Laboratory Equipment Qualification

Before use the laboratory equipment, members need to pass the equipment qualification.

To find a person who will provide a training, a member may send a Training Request to all qualified members, to members with current reservations, or to super users. This option is available at *MercuryWeb*.

To send a Training Request, a member needs to enter an equipment name in <Request Qualify> field at the Equipment section on the Member page.

	Marvell Nanofabrication Laboratory University of California, Berkeley	4.0 build(2018012
Member		Logout
Activity <u>Reservations</u> <u>LabHist</u> <u>Labwho</u> <u>Suggestions</u> <u>All Problem Status Board</u> <u>Buddies</u> <u>Available Equipment Tests</u>	Equipment All Equipment Status Engineers/Keyops EMail equipment Enabled equipment Manuals View Header Request Qualify	Qualifications My Qualifications By Equipment By Member Requalify Qualification Test Qualification Rules Facility Safety Test
Member Information <u>Member Gallery</u> <u>Staff Gallery</u> <u>Find Members</u> <u>Recognitions</u> <u>Safety Incidents</u> <u>Suspended Members</u>	<u>Lab Materials</u> <u>Chemicals</u> <u>Machine Shop</u>	Process <u>Problem History Search</u> <u>Parameter History Search</u> <u>Mask Request</u> <u>Quality Monitor List</u>

Figure 2. Request Qualify option

Training Request form will be open in the new window. A member needs to type a message and select the group of members whom they want to send this request.

(Marvell Nanofabrication Laboratory University of California, Berkeley	4.0 build(20160128)
Member		Logout
Subject	Qualification Request	
Message		
Destination	\odot Equipment Alias (All Qualified) \odot Members with Current Reservations \circledast Superusers	
	Send	

Figure 3. Training Request

The list of equipment qualification online tests can be found at *MercuryWeb* on the Member page, by clicking on <u>Available Equipment Tests</u> link in the Activity section.

Note: Not all equipment tests are online. There are some tools that require a written qualification test, to take these tests members need to go to the NanoLab office and ask the front desk for the test they need.

By clicking on <u>My Qualifications</u> link, members may view the list of already passed qualifications and its details. Qualifications have expiration dates, and by clicking on <u>Qualification Rules</u> members may review the qualification expiration rules.

	Marvell Nanofabrication Laboratory University of California, Berkeley	, 4.0 build(20180128)
Member		Logout
Activity <u>Reservations</u> <u>LabHist</u> <u>Labwho</u> <u>Suggestions</u> <u>All Problem Status Board</u> <u>Buddies</u> <u>Available Equipment Tests</u>	Equipment All Equipment Status Engineers/Keyops EMail equipment Enabled equipment Manuals View Header Request Qualify	Qualifications My Qualifications By Equipment By Member Requalify Qualification Test Qualification Rules Facility Safety Test
Member Information <u>Member Gallery</u> <u>Staff Gallery</u> <u>Find Members</u> <u>Recognitions</u> <u>Safety Incidents</u> <u>Suspended Members</u>	Lab Materials Chemicals Machine Shop	Process Problem History Search Parameter History Search Mask Request Quality Monitor List

Figure 3. The Qualifications section on the Member page

To find the laboratory members who are already qualified to work on a piece of equipment, a member may enter the equipment name in <By Equipment> field.

MercuryWeb tips

All equipment and members names are present in lowercase and input is case sensitive. Start typing a name and the list of 16 first possible entries will show up in the pop up window; select the required name, or finish typing it and hit Enter to get results.

To find what qualifications a laboratory member has, a member may enter the login name of that person in the <By Member> field. Members and staff login names can be found at <u>Member Gallery</u> and <u>Staff Gallery</u> links at the Member Information section on the Member page.

To find and take equipment qualification test, a member needs to enter the name of that equipment in <Qualification Test> field. As with all qualification tests, a test can be taken only from the NanoLab office computers, otherwise a member will see the following error message:

You may take Equipment Qualification Test only from terminal located in SDH520.

If a member fails a test, they may retake it. The time that the member must wait to retake a test depends on the test, and can be 1, 2, 4, 12 or 24 hours. This information is shown when a member tries to take the test again. If the member fails the equipment qualification test second time, they must review the test with the test grader.

If the equipment qualification expires, a member will need to take the qualification test again. For some equipment, there are equipment re-qualification quizzes. To find and take a requalification quiz, a member may enter the equipment name in <Requalify> field. If a quiz for this equipment is present, it will show up in the pop up window.

MercuryWeb tips

Enter the question mark '?' in a text field to see 16 first available entries.

4.2 Access to the Laboratory

Every NanoLab member must login to Mercury Client before entering the NanoLab.

Step 1

From computers located in the laboratory gowning room, a member needs to login to a personal Windows® terminal, *CAPE*, by clicking on the *CAPE3* icon and entering their login and password.



Figure 4. Computers at the laboratory gowning room

Step 2

From the *CAPE* terminal, the member needs to login to *Mercury Client* by clicking on the *Mercury* icon, entering their login and password, and specifying a Project they are working on.

If a member has more than one project then they may switch projects after login into *Mercury Client* by clicking on the 'Set Project' button on the top of the main window.

Mercury Project - (06/15/15)						- • · ×
Lab Member: micro, Project: PR-S	TAFF		Logout Set Project 🚽 MercuryWeb)		
Mercury Project	Action Press to Refres	n Table				
▼ Resources	Equipment					
Equipment						Equipment
Litilities	NAME	STA	DESCRIPTION	MEMBERNAME	TIME_ENABLED	
Oundes	4ptprb		Four Point Probe - Miller Design/Automat (380)			
Locations	4ptprb2		Four Point Probe - Manual (380)			



Keep it in mind

If a member has more than one project and they are going to work on several projects simultaneously, they will need to switch projects at *Mercury Client* each time before using the laboratory equipment to avoid mistakes in his/her monthly charges.

Step 3

After login, the member needs to click on the *HIDECAPE* icon to leave the computer terminal available for other members.

HIDECAPE leaves a session active and members always can login back into to their *CAPE* terminal from any computer located in the laboratory by clicking on the *CAPE3* icon.

Any *CAPE* terminal will be auto-hidden after 10 minutes of inactivity to make the laboratory computer terminals available for other members.

Laboratory rules

I. If there is nobody in the NanoLab then a member will see the following warning message during an attempt to login to *Mercury Client*:

Working Alo	ne is Against Policy						
There are no members signed into the laboratory. WARNING: It is against policy to work alone in the laboratory!							
Account:		Password:		Projects:			
					OK Cancel		

Figure 6. Warning message at Mercury Client login

Members may proceed with login but <u>only</u> if they are going to login together with somebody else because it is against NanoLab policy to work alone in the lab

Keep it in mind

Members need to plan their work ahead to be sure that they will not work alone in the laboratory.

Members may use the Buddies feature on *MercuryWeb* to find people who will work in the laboratory together with them. Buddies is described in the paragraph 4.5.3.

II. After a member is finished with work in the cleanroom, they need to disable all equipment that was used and logout from *Mercury Client*.

Leaving equipment in enabled state is dangerous and makes the cleanroom unsafe. It also leads to overcharging a member for the equipment usage. Leaving the *Mercury Client* session on leads to overcharging a member for the laboratory time.

Note: In case of long time process that runs on the equipment, a member may leave the cleanroom and leave this equipment on, and only logout from *Mercury Client*.

III. During logout from *Mercury Client*, if there are <u>3 or less people</u> left in the cleanroom, a member who just logged out will be notified about it with the warning message. If a member sees such notification, they need to inform members who are working in the cleanroom that they are only researchers still in the laboratory and remind them that it is against the laboratory rules to work alone.

4.3 Laboratory Resource Usage

The laboratory resources may be divided on the following groups:

- Equipment a piece of equipment in the laboratory
- Utilities resources like power, water or different gases that are connected to the equipment
- Supplies the laboratory materials and chemicals
- Locations rooms with one or more pieces of equipment.

4.3.1 Equipment Reservation

For NanoLab members' convenience, *MercuryWeb* provides the ability to make equipment reservations so members may plan their work ahead.

Due to some equipment being more popular than others, there is a list of equipment reservation rules. Members may find these rules at *MercuryWeb* on the Reservations page.

To open this page, a member needs to click on <u>Reservations</u> link at the Activity section on the Member page.

	Marvell Nanofabrication Laboratory University of California, Berkeley	4.0 build(20160128)
Member		Logout
Reserve equipment		
My Reservations	Reservations	
Today	<u>Au</u> Today	
This week	This week	
By equipment	By equipment	
	By member All Rules	
	Rules for	
	EMail	
	Back	

Figure 7. The Reservations page

By clicking on <u>All Rules</u> link, a member may view the list of all equipment reservation rules.

To find a reservation rule for the specific equipment, a member may enter the equipment name in <Rules for> field.

To make an equipment reservation, a member needs to proceed with the following steps:

1. Enter the equipment name in <Reserve equipment> field, and the equipment reservation calendar will be shown in the new window.

	Marvell Nanofabrication Laboratory University of California, Berkeley 4.0 buildigt								
Member									Logout
00:00	Wed, Feb 10	Thu, Feb 11	Fri, Feb 12	Sat, Feb 13	Sun, Feb 14	Mon, Feb 15	Tue, Feb 16		1 Day>
00:30					currer	nt reservation		E	1 Month>
01:30 02:00				micro					
02:30 03:00				l I					
03:30								Į	
04:30								Į	< 1 Month < 1 Week
06.00	<u>}</u>			Í	<u>}</u>	ţ		Ŧ	< 1 Day
Start	Finish	1	Periodic		•	Periodic fin	ish		
Comment									
				Back					

Figure 8. Equipment reservation calendar

All already scheduled reservations for this equipment will be shown on the calendar.

2. Select a time when they are going to start working on this equipment

3. Select a time when they will finish the work, plus an extra 30 minutes. For example: to set a reservation timeframe between 00:00 and 02:00 select a finish time of 02:30. By saving the reservation, the timeframe will be set between 00:00 and 02:00. If somebody else's reservation starts at 02:30, select the start time of that reservation, example is shown on the picture below:



Figure 9. Example of how to set an equipment reservation timeframe

- 4. Add a comment (optional)
- 5. Click on the Reserve button. Or click on the Cancel button to change the reservation.

Members cannot override somebody else's reservations, but can edit or delete their own reservations.

To edit a reservation, a member may click on the reservation at the calendar, press the Edit button, select a new start and finish time and confirm changes by pressing the Reserve button.

	Marvell Nanofabrication Laboratory University of California, Berkeley 4.0 build(20160128)								
Member									Logout
	Wed, Feb 10	Thu, Feb 11	Fri, Feb 12	Sat, Feb 13	Sun, Feb 14	Mon, Feb 15	Tue, Feb 16		1 Day>
00:00	<u> </u>				ľ	ľ	ľ	*	1 Week>
00:30	ĺ		micro		ĺ	[[1 Month>
01:00	[]				ĺ		[=	
01:30									
02:00					[
02:30			micro		[[[
03:00					[[
03:30					[
04:00					[
04:30					[[[< 1 Month
05:00					[[[< 1 Week
05:30					[[< 1 Day
06.00					I	I	[Ŧ	
Start 00:30 Finish 03:00 Periodic Single Periodic finish									
Comment									
Edit or	Delete or	Cancel		Back]				

Figure 10. Edit and delete a reservation options

To delete a reservation, a member needs to click on the reservation at the calendar, press the Delete button, and confirm changes.

At the Reservations page on *MercuryWeb*, members may also view their equipment reservations, all equipment reservations for the specific equipment or equipment reservations

that were made by a specific member. These options are available at the My Reservations and Reservations sections that are shown on the figure below.

	Marvell Nanofabrication Laboratory University of California, Berkeley	
Member		Logout
Reserve equipment		
My Reservations <u>All</u> <u>Today</u> <u>This week</u> By equipment	Reservations All Today This week By equipment By member All Rules Rules for EMail	
	Back	

Figure 11. My Reservations and Reservations sections on the Reservations page

At the Equipment page on *Mercury Client*, members may view equipment reservations for the specific equipment, but cannot delete or edit current reservations.

To view equipment reservations at *Mercury Client*, a member needs to open the Equipment page, choose an equipment, open its context menu and click on View Reservations option.

NAME	STA	DESCRIPTION	MEMBERNAME		
reichert		Reichert Polylite inspection microscope (380)			
resources		To Request Restock of Lab Consumables (na	a		
rtp1		AccuThermo AW610 RTP for III/V or PZT (58	<u>, </u>		7
rtp2		AccuThermo AW610 RTP III/V -no metal (582	En	able	
rtp3		AccuThermo AW610 RTP Si Non-MOS (386)	AccuThermo AW610 RTP Si Non-MOS (386) View		
rtp4		AccuThermo AW610 RTP Si MOS Clean (386	Vie	w Reservations	
rtp8		ccuThermo AW810 RTP Si MOS Clean (386		and Mail	
safety		Use to enter any lab related safety prob (nan	Se		
sca		Surface Charge Analyser (386)	Re	port Problems	
semi		Semigroup plasma etcher (584)	Ent	ter Comments	
shippingstation		Table and accessories for shipment prep (5	Ent	ter Parameters	

Figure 12. View Reservations option

The table with a list of all reservations for that equipment will be shown in a new window.

4.3.2 Find Equipment Manuals

All major laboratory equipment has a lab manual prepared by process engineers. Before starting to use a tool or piece of equipment, a member must read the equipment manual and take the equipment qualification test.

Equipment manuals can be found on Mercury Client and MercuryWeb.

At Mercury Client.

To find an equipment manual, a member needs to open the Equipment page, select the equipment, open its context menu and click on Manual option.

NAME	STA	DESCRIPTION			NAME
primeoven		Yield Engineering Systems YES - 5 (38	ngineering Systems YES - 5 (38		
probe1		Large black Faraday cage with probe s Enable			
probe2		Copper door Faraday cage with probe	View Probl	em	
ptherm		Plasmatherm reactive ion etcher (582)	View Rese	rvations	
quintel		Quintel Q4000-6IR Contact Printer (382	Send Mail		
randex	•	Randex sputtering system (582)			
refrigerators		Refrigerators for Chem Storage 381 &	Report Pro	blems	
reichert		Reichert Polylite inspection microscop	Enter Com	ments	
resources		To Request Restock of Lab Consumal	Enter Parameters		
rtp1		AccuThermo AW610 RTP for III/V or PZ	Maintenance		
rtp2		AccuThermo AW610 RTP III/V -no meta	mainternance		
rtp3		AccuThermo AW610 RTP Si Non-MOS	Qualified M	lembers	
rtp4		AccuThermo AW610 RTP Si MOS Clea	cuThermo AW610 RTP Si MOS Clea Super Users		
rtp8		AccuThermo AW810 RTP Si MOS Clea Engineers			
safety		Use to enter any lab related safety prot			
sca		Surface Charge Analyser (386)	Use-Histor	У	
semi		Semigroup plasma etcher (584)	Problem H	istory	
shippingstation		Table and accessories for shipment p	Comment History		
sinkcmp		CMP Wet-sink (cory-190)		oine	
sinkcmp2		Sink in 582A for dicso and gnpcmp (58	Dependen	ues	
sopra		Sopra Variable Angle/Frequency Ellips Manual			
sp3		sp3 CVD Diamond Coating System (5%)			

Figure 13. Equipment manual option

The Manual will be open in a new Internet browser window.

At MercuryWeb:

To find an equipment manual, a member needs to click on <u>Manuals</u> link at the Equipment section and select their needed manual from the list of all equipment manuals.

	Marvell Nanofabrication Labor University of California, Berk	ratory kelev
Member		4.0 build[20160128
Activity <u>Reservations</u> <u>LabHist</u> <u>Labwho</u> <u>Suggestions</u> <u>All Problem Status Board</u> Buddies	Equipment All Equipment Status Engineers/Keyops EMail equipment Enabled equipment Manuals View Header	Qualifications My Qualifications By Equipment By Member Requalify Qualification Test Oualification Rules
Available Equipment Tests	Request Qualify	Facility Safety Test
Member Information Member Gallery Staff Gallery Find Members Recognitions Safety Incidents Suspended Members	<u>Lab Materials</u> <u>Chemicals</u> <u>Machine Shop</u>	Process Problem History Search Parameter History Search Mask Request Quality Monitor List

Figure 14. The Equipment section on the Member page

4.3.3 Review Resource Status

Each laboratory resource, like equipment, utility or location, has a status. Resource status depends on current problems reported to that resource. The list of possible resource statuses is described below:

- A normal, means that a resource has no issues, and if it is a piece of equipment then members can enable it
- - warning, means that a resource has some issues and it may affect members' work, before a member will enable an equipment with warning status, they need to read about current issues to determine if it may affect their work
- **V** fatal, means that a resource has major issues, and members cannot use it
- X black cross, means that an equipment is locked due to one or more of its depended utilities in a fatal state

Members may see the laboratory resource status at Mercury Client and MercuryWeb.

At Mercury Client:

Members may see resource status in the second column of the resource table.

NAME	STA	DESCRIPTION	MEMBERNAME	TIME_ENABLED
4ptprb		Four Point Probe - Miller Design/Automat (380)		
4ptprb2		Four Point Probe - Manual (380)		
accounting	•	Use to request accounting adjustments (520)		
afm2		Digital Instruments AFM (cory-151)		
aln2		Tegal Endeavor AT sputter deposition sy(584)	N. Contraction of the second s	
amatepi	•	epitaxial silicon / germanium deposition (586)		

Figure 15. Example of the equipment table

At MercuryWeb:

Members may review equipment status by clicking on the <u>All Equipment Status</u> link at the Equipment section on the Member page.

Resource [†]	Status	Description	Enabled By	
cpd	•	Tousimis 915B 6" Critical Point Dryer		*
cpd2		Tousimis 815A 1.5" Critical Point Dryer		
cpdsink		CPD Sink - Bay 382		Ξ
crestec		Crestec EBEAM Lithography		
dcl		For Problem Reports - No Enable Require		
dektak		Dektak Model 3030 Surface Profilometer		
diebonder	A	MEI 779 Die Bonder		
disco	A	Disco DAD3240 Automated Dicing Saw		
drystation1		Drying Station - Bay 382		
edwards		Edwards Sputter System		
edwardseb3		Edwards 306 E-Beam System		
edx	•	Energy-dispersive X-ray Spectroscopy		-

Figure 16. Example of the equipment status table

MercuryWeb tips

By clicking on the column header, the table maybe sorted by values in this column in ascending or descending order.

To review all current laboratory resource problems, a member may click on <u>All Problem Status Board</u> link at the Activity section on the Member page.

Marvell Nanofabrication Laboratory University of California, Berkeley 4.0 build(2016012)					
Member				Logout	
Activity	Equip	oment	Qualific	ations	
<u>Reservations</u>	All Equipment State	us	My Qualifications		
<u>LabHist</u>	Engineers/Keyops		By Equipment		
<u>Labwho</u>	EMail equipment		By Member		
Suggestions	Enabled equipment	t	Requalify		
All Problem Status Board	Manuals		Qualification Test		
Buddies	View Header		Qualification Rules		
Available Equipment Tests	Request Qualify		Facility Safety Test		
Member Information			Proc	ess	
Member Gallery	Lab Materials		Problem History Se	arch	
Staff Gallery	Chemicals		Parameter History	Search	
Find Members			Mask Request		
Recognitions	Machine Shop		Quality Monitor List	ţ	
Safety Incidents					
Suspended Members					

Figure 17. All Problem Status Board link

The list of resources and their reported problems will be shown in a new window.

4.3.4 Enable Equipment

The laboratory equipment can be enabled or disabled only at Mercury Client.

A member can enable a piece of equipment if:

- the member has been qualified for this equipment
- this equipment is in disabled state
- and status of this equipment is normal or warning (not fatal)

To enable equipment, a member needs to open the Equipment page at *Mercury Client*, select the required equipment, open its context menu and click on Enable option.

NAME	STA	DESCRIPTION MEMBERNA			1E
amst		AMST Molecular Vapor Deposition (582A)			
aptchrome		APT chrome mask developer (382a)	APT chrome mask developer (382a) Enable		
aptemul		APT emulsion mask developer (382a) View Problem		roblem	
argus		ARGUS lab camera system (581) View B		eservations	
asiq		Tencor AS500 Profilometer (584)		loil	
asml300		ASML 5500/300 DUV Stepper (384)		Idii	
autoprobe		Electroglass Autoprobe in DCL (cory-355) Report Problems		Problems	
axcelis		Axcelis photoresist UV bake system (584) Enter Co		comments	

Figure 18. Enable equipment option

If an equipment is in the warning state before it is enabled, members will see the pop up window with Reported Problems. If there are upcoming reservations then a member will be notified about it in the same popup window.

Immediate R	eservations		
micro	15:00 to	15:30	
			Continue Cancel

Figure 19. Example of a notification window at the enable equipment procedure

To continue with the enable equipment procedure, a member needs to press Continue button.

4.3.5 Disable Equipment

To disable equipment, a member needs to open the Equipment page at *Mercury Client*, select the required equipment, open its context menu and click on Disable option.

After the disable equipment procedure, a member will see the following pop up window where he/she will be asked if there are any equipment problems to report.



Figure 20. Pop up window at the disable equipment procedure

By answering "Yes", a member will be asked to file an equipment Problem Report, shown on the picture below.

Equipment:	computers select from list
Symptom 1:	
Symptom 2:	
CC:	
Severity:	○ Fatal (prevent enabling)
Description:	
	Cancel Save (Symptom 1 required)

Figure 21. Problem Report form

To file a problem report, a member needs to:

- 1. Select a Symptom
- 2. Add CC recipients (optionally)
- 3. Choose an appropriate severity
- 4. Describe the problem. Problem description should be detailed and include an explanation of the problem, actions performed before the problem occurred, and what steps were done to correct it.
- 5. Press the Save button to send the Problem Report, or press the Cancel button to discard it.

The problem report will send an e-mail to the process engineers and equipment engineers assigned to this equipment, and to all members with current reservations. The problem report will also be stored in the equipment problem reports history.

4.3.6 Report Problems

Members may file a problem report at any time. To do that, a member needs to login *Mercury Client*, open the appropriate resource page like Equipment, Utilities or Locations, select an equipment, utility or location that has a problem, open its context menu and click on Report Problems option.

NAME	STA	DESCRIPTION	DESCRIPTION		
autoprobe		Electroglass Autoprobe in [OCL (cory-355)		
axcelis		Axcelis photoresist UV bake	e system (584)		
bagsealer		Plastic Bag Thermal Seale	(602)		
bottlewash		For Problem Reports - No I	Enable		
bottlewash2		For Problem Reports - No	View Problem		
cambridge		Cambridge Fiji F200 Plasn	View Reservations		
canon	•	Canon 4X wafer stepper (3	Cond Mail		
cascade1		Cascade Probe Station - 1	Send Mail		
cascade2		Cascade Probe Station - 2	Report Problems		
cde-resmap		CDE 4-ptprb Automated Ma	Enter Comments		

Figure 22. Report Problems option

A Problem Report will be open in the new window, and a member will need to fill it as it's described above in the paragraph 4.3.5.

You may find Equipment Problem Reporting e-mail notifications rules in the Appendix 1.

4.3.7 Review Problem History

Members may review the history of problem reports for any equipment, utility or location.

This option is available at *Mercury Client* and *MercuryWeb*.

At Mercury Client.

To review the history of problem reports for an equipment, a member needs to open the Equipment page, select an equipment, open its context menu and click on Problem History option.

NAME	STA	DESCRIPTION			MEMBERNAME
quintel		Quintel Q4000-6IR Co	ntact Printer (382)		
randex		Randex sputtering sy]	
refrigerators		Refrigerators for Cher	Enable	anol	
reichert		Reichert Polylite inspe	View Problem		
resources		To Request Restock (View Reservations	anol	
rtp1		AccuThermo AW610 F	Send Mail		
rtp2		AccuThermo AW610 F		-	
rtp3		AccuThermo AW610 F	Report Problems		
rtp4		AccuThermo AW610 F	Enter Comments		
rtp8		AccuThermo AW810 F	Enter Parameters		
safety		Use to enter any lab r	Maintenance	lab)	
sca		Surface Charge Analy	Maintenance	-	
semi		Semigroup plasma el	Qualified Members		
shippingstation		Table and accessorie	Super Users	3)	
sinkcmp		CMP Wet-sink (cory-1	Engineers		
sinkcmp2		Sink in 582A for dicso			
sopra		Sopra Variable Angle/	Use-History		
sp3		sp3 CVD Diamond Co	Problem History		
sp3seeding		sp3 Diamond Wafer S	Comment History		

Figure 23. Problem History option

The table of all problem reports for that equipment will be shown in the new window. To view reports, a member needs to select a report, open its context menu and click on Read Details option.

EQ	CREAT	SYMPTOM	DESCRIPTION		
can	2016-0	maintenance	Lama shares di a dal		
can	2015-1	mechanics	Th Read Details d		
can	2015-0	maintenance	W Cancel h		
can	2015-0	process	Digital See any exposit		

Figure 24. Read Details option

The problem description will be shown in the new window.

In the same way, a member may review the history of problem reports for utilities or locations, at the Utilities or Locations page accordingly.

At MercuryWeb:

To find and review the history of problem reports for an equipment, utility or location, a member needs to open the Search Problem History page by clicking on <u>Problem History Search</u> link at the Process section on the Member page.

	Marvell Nanofabrication Lal University of California, B	poratory erkeley
Member		+us constant on the Logout
Select one of Equipment Utility Location and / or		
Member		
Restrict by from/to d	ate	œ
Choose search type	Search for any keyword Search for all keywords Search	Back Search Hints

Figure 25. The Search Problem History page

To find the history of problem reports, a member needs to:

- Specify an equipment, utility or location name; OR specify a member's name. If a member specifies
 an equipment, utility or location name together with a member's name then the history of problem
 reports for this equipment, utility or location will be filtered by the member's name, i.e. the results of
 the search of problem reports will include only reports where the specified member was involved
 (for example, the specified member filed a problem report or responded to the problem)
- 2. Specify keywords to filter the results; OR specify a time frame of the history of problem reports
- 3. Select a search type
- 4. Press Search button to get the results

The results will be shown in the new window. A member may use navigation buttons Next, Previous, First, and Last to go through the list of results.

4.3.8 Find Process and Equipment Engineers

All laboratory equipment has assigned process and equipment engineers. Process/equipment engineer 1 is in charge of that equipment. Process engineer 1 approves a special process on an equipment.

Members may find engineers assigned to an equipment at Mercury Client or MercuryWeb.

At Mercury Client:

To find process and equipment engineers, a member needs to open the Equipment page, select an equipment, open its context menu and click on Engineers option.

NAME	STA	DESCRIPTION MEMBERNAM			ΛE
amst		AMST Molecular Vapor Deposition (582A)			1
aptchrome		APT chrome mask developer (382a)	Enable	;	
aptemul		APT emulsion mask developer (382a)	View P	roblem	
argus		ARGUS lab camera system (581)	View R	eservations	
asiq		Tencor AS500 Profilometer (584)	Condi	Aoil	
asml300		ASML 5500/300 DUV Stepper (384)	Send Mail		
autoprobe		Electroglass Autoprobe in DCL (cory-355)	Report Problems		
axcelis		Axcelis photoresist UV bake system (584)	Enter Comments		
bagsealer		Plastic Bag Thermal Sealer (593)		Parameters	
bas		To report problems with Siemens BAS (52			
beadblaster		Bead Blasting Cabinet - 280 SDH (280)	Maintenance		
bottlewash		For Problem Reports - No Enable Require	Qualified Members		
bottlewash2		For Problem Reports - No Enable Require	Super Users		
cambridge		Cambridge Fiji F200 Plasma ALD (586)	Engineero		
canon		Canon 4X wafer stepper (382)	Engineers		
cascade1		Cascade Probe Station - 1 (cory-355)	Use-History		

Figure 26. Equipment engineers option

The list of assigned process and equipment engineers will be shown in the new window. At this table members may find engineers' membername, full name, office and phone information.

At MercuryWeb:

To find process and equipment engineers assigned to an equipment, a member needs to enter the equipment name in the <Engineers/Keyops> field at the Equipment section (Figure 15).

The list of engineers will be shown in the new window. There is only engineers' membername information. To get full name and contact information, members may find staff engineers in the <u>Staff</u> <u>Gallery</u> and click on the full name link.

4.3.9 Find Laboratory Supplies

Members may view the list of the laboratory supplies (i.e. materials and chemicals), its amount in stock, and price.

This option is available at MercuryWeb.

To view available materials like wafers or beakers, a member needs to click on Lab Materials link.

To view available chemicals, a member needs to click on Chemicals link.

	Marvell Nanofabrication Laborat University of California, Berkel	0 FY 2Y 4.0 build(20160128
Member		Logout
Activity	Equipment	Qualifications
LabHist LabHist Suggestions All Problem Status Board Buddies	Engineers/Keyops EMail equipment Enabled equipment Manuals View Header	My Qualifications By Equipment By Member Requalify Qualification Test Qualification Rules
Available Equipment Tests	Request Qualify	Facility Safety Test
Member Information <u>Member Gallery</u> <u>Staff Gallery</u> <u>Find Members</u> <u>Recognitions</u> <u>Safety Incidents</u> <u>Suspended Members</u>	Lab Materials Chemicals Machine Shop	Process <u>Problem History Search</u> <u>Parameter History Search</u> <u>Mask Request</u> <u>Quality Monitor List</u>

Figure 27. Lab Materials and Chemicals links

Both links will be open a new window with a table of available supplies. At this table members may find information about supplies' SKU (stock keeping unit) number, location, its current amount in the stock and fee for using it.

4.4 Laboratory Fees and Charges

4.4.1 Review Laboratory Fees

Members may review the laboratory fees for resource usage at any time.

This option is available at *Mercury Client*. At *MercuryWeb*, members may review fees only on the laboratory materials and chemicals usage (Find Laboratory Supplies, the paragraph 4.3.9).

To review the laboratory prices for chemicals use, a member needs to open the Chemicals page.

Mercury Project	Action Press to Refresh	Table	
Resources	Chemicals		
Equipment	SKI	DESCRIPTION	PRICE(\$)
Utilities	20001	Isopropyl Alcohol (2-Propagal)	19.26
Locations	20002	AZ EBR 70/30	38.41
▼ Fees	20003	Acetic Acid, ACS, (500ml)	11.70
Chemicals	20004	Acetone, (4 I)	19.14
Materials	20005	Aluminum Etchant, (1 gal)	85.36
Equipment fees	20006	Ammonium Fluoride, (7 lb)	30.19
Equipmentiees	20007	Ammonium Hydroxide, (2.5 I)	23.66
General Lab fees	20008	Buffered Hydrofluoric Acid 10 1 (9lb)	59.19
My Lab Charges	20009	Buffered Hydrofluoric Acid 5 1 (9lb)	50.95
▼ View	20010	CA-40 Photomask Cleaner, gal	10.26
View Qualifications	20011	CR-7 Chromium Photomask Etchant, (1 gal)	49.28
Who is suspended	20012	Carbon Tetrachloride, (4 I)	13.13
who is suspended	20013	Chlorobenzene, (500 ml)	17.22
who is in the lab	20014	Cool Grease 7016, CGR7016	188.56
NanoLab	20015	Dessicant, Drierite, 5lb	0.00
Visitors	20016	Disilane gas (Si2H6)	0.02

Figure 28. The Chemicals fees page

To review the laboratory fees for materials, a member needs to open the Materials page. Price for materials usage are shown in dollars per each unit.

Mercury Project	Action Press to Refrest	n Table		
▼ Resources	Materials			
Equipment	SKU	DESCRIPTION	PRICE(\$)	UNIT
Utilities	70002	Wafer 4", Poly Control Si	24.00	each
Locations	70003	Wafer 4", Poly-on-Oxide Si	35.00	each
▼ Fees	70004	4oz. Nalgene Bottle	0.45	each
Chemicals	70005	6" Wafer Jar w/lid	2.01	each
Materials	70006	Wafer 6", Poly Control Si	30.00	each
Equipment fees	70007	Wafer 6", Poly-on-Oxide Si	40.00	each
Conservations	70008	8oz. Nalgene bottle	0.63	each
General Lab tees	70009	AFM2 Tapping Tip, Tap300, each	23.05	each
My Lab Charges	70010	AMST Sample Cylinder, SS-4CS-TW-50	132.85	each
View	70011	Adhesive Mats, each	11.45	each
View Qualifications	70012	Aluminum Foil, Heavy Duty, 18" x 500'	47.27	each
Who is suspended	70013	Aluminum Staples/100	0.12	pack/100
Who is is the left	70014	Ampule quartz, amst	97.73	each
who is in the lab	70015	Apron, Blue Chemical Resistant	2.43	each
NanoLab	70016	Bag,polyethylene,24x24x6ml	2.48	each
Visitors	70017	Battery, 9v alkaline	2.10	each

Figure 29. The Materials fees page

To review the laboratory fees for equipment usage, a member needs to open the Equipment fees page. Fees for equipment usage are shown in dollars per 1 minute of usage.

Mercury Project	Action Press to Refresh	Table			
Resources	Equipment fees				
Equipment	NAME	DESCRIPTION	PPICE(\$)	LINIT	
Utilities		Eaus Baint Backs, Milles Dasies (Automat			
Locations	4ptprb	Four Point Probe - Miller Design/Automat	0.00	minute	
/ Fees	4ptp1b2	Four Point Probe - Manual	0.00	eacri	
Observiceda	accounting	Digital leateumente AEM	0.00	minute	
Chemicals	alm2	Tagel Endeaver AT enuiter depention ex	0.00	minute	
Materials	diliz	anitavial ailiaan (aarmanium danaaitian	0.72	minute	
Equipment fees	amatepi	epitaxial silicon / germanium deposition	0.72	minute	
General Lab fees	antehromo	AMST Molecular vapor Deposition	0.72	minute	
My Lab Charges	aptemul	APT chrome mask developer	0.00	minute	
l View	aptentiui	Tapaar ACEO0 Brafilematar	0.00	minute	
view	asiq	ACML EEGO/200 DLIV Chapper	0.72	minute	
View Qualifications	asmisou	ASML 5500/300 DOV Stepper	0.72	minute	
Who is suspended	autoprobe	Electroglass Autoprobe III DCL	0.00	minute	
Who is in the lab	axcens	Accells photoresist OV bake system	0.00	minute	
/ Nanol ab	bagsealer	Plastic Bag Thermal Sealer	0.00	each	
Visitoro	bottlewash	For Problem Reports - No Enable Required	0.00	each	
VISITOLS	bourewash2	Por Problem Reports - No Enable Require	0.00	minute	
	cambridge	Cambridge Fiji F200 Plasma ALD	0.72	minute	
	Cation	L Canon 4A water stepper	10.72	Immute	

Figure 30. The Equipment fees page

To review the general cleanroom access fees, a member needs to open the General Lab fees page.

This group of charges includes:

- A fee for the cleanroom access (NANOLAB, CORYHALL) that is charged one time per month;
- A fee for the time spent in the cleanroom (nanolab and 131), this charge applies per minute.

Mercury Project	Action Press to Refre	sh Table)				
Resources	General Lab fees					
Equipment				DESODIPTION	DDIOE(E)	LINUT
Utilities	CHARGE CLASS	CHARGE ITPE	LUCATION	DESCRIPTION	PRICE(\$)	UNIT
Locations	member	Lab Fee	NANOLAB	Marvell Nanorabrication Laboratory	91.00	each
T Fees	member	Lab Fee	121	Nonel of Matrology Conter	29.00	eacri
Chemicala	member	Lab Time	adjust Jahtima	Lise for adjustment of labtime	0.75	minute
Untertaile	member	Lab Time	nanolah	The Facilities of the Marvel Nanol ab	0.75	minute
Materials	member	Lab mile	Inditoldo	The Facilities of the marver realities	0.75	minute
Equipment fees						
General Lab fees						
My Lab Charges						
▼ View						
View Qualifications						
Who is suspended						
Who is in the lab						
▼ NanoLab						
Visitors	n					

Figure 31. The General Lab fees page

4.4.2 Review Laboratory Charges

Members may review their current laboratory charges at any time.

This option is available at *Mercury Client* and *MercuryWeb*.

At Mercury Client:

To review the current laboratory charges, a member needs to open the My Lab Charges pages. The table with all charges for the current month will be shown in the new window.

At MercuryWeb:

To review the current laboratory charges, a member needs to open the Lab History page by clicking on the <u>LabHist</u> link at the Activity section on the Member page.

	Marvell Nanofabrication Laboratory University of California, Berkeley	4.0 build(20160128
Member		Logout
Select at least or	ne of the following fields	
Login name Resource Project	micro or SKU	
Select period ran	Ige Jan-25-2016 ▼	
	Feb-25-2016 💌	
	Search Back	

Figure 32. The Lab History page

At the Lab History page, a member needs to select a period for which he/she wants to get a lab charges report and press on Search button. Period range is limited by the current month and last two historical months. By default the period is set to the current month.

In addition, a member may filter the lab charges report by the specific project and resource (i.e. equipment, location, material or chemical).

To filter by an equipment or location, a member needs to enter the equipment or location name in the <Resource> field, and press Search button. Possible locations are "nanolab" - NanoLab cleanroom; and "131" - NanoLab Metrology Center.

To filter by a chemical or material, a member needs to enter SKU (stock keeping unit) number of the chemical or material in <SKU> field, and press Search button.

To filter by a project, a member needs to enter the project name in <Project> field, and press Search button.

4.5 Sending E-mails

4.5.1 E-mail Forward

Every NanoLab member has an e-mail address like <membername>@silicon.eecs.berkeley.edu.

Every e-mail that are sent to a member's NanoLab e-mail address will be forwarded to e-mail that they provided during the registration at the New Member form.

4.5.2 Contact with Members

Members may e-mail any member by using <membername>@silicon.eecs.berkeley.edu e-mail address.

Members may send e-mails from the system to the group of members. Possible groups are listed below:

- Equipment all engineers assigned to the equipment and all members who qualified to work on the equipment
- Superusers all equipment super users
- Members with Current Reservations all members who has reservations for the equipment.

This option is available at *MercuryWeb*. At *Mercury Client*, members may send e-mails only to Equipment group.

At Mercury Client:

To send an e-mail, a member needs to open the Equipment page, select an equipment, open its context menu and click on Send Mail option.

NAME	STA	DESCRIPTION	DESCRIPTION	
axcelis		Axcelis photoresist UV bake	system (584)	
bagsealer		Plastic Bag Thermal Sealer	(502)	
bottlewash		For Problem Reports - No E	Enable	
bottlewash2		For Problem Reports - No E	View Problem	
cambridge		Cambridge Fiji F200 Plasm	View Reservations	
canon	•	Canon 4X wafer stepper (38	Cond Mail	
cascade1		Cascade Probe Station - 1 (Send Mail	
cascade2		Cascade Probe Station - 2 (Report Problems	
cde-resmap		CDE 4-ptprb Automated Mar	Enter Comments	
centura-3-5		Centura Compound Etch - C	Estas Deservations	

Figure 33. Send Mail option

The equipment e-mail form will be open in the new window. A member needs to write a subject and a message, add CC recipients (optional), and press the Send button. This message will be sent to Equipment group.

Send Mail option is also available for utilities and locations. In this case, an e-mail will be sent to all engineers and keyops assigned to this utility or location.

At MercuryWeb:

To send an e-mail, a member needs to enter an equipment name in <EMail equipment> field at the Equipment section (Figure 15) or in <EMail> field on the Reservations page (Figure 8).

	Marvell Nanofabrication Laboratory University of California, Berkeley	4.0 build(20160128)
Member		Logout
Resource	crestec	
Subject		
Message		
Destination	\odot Equipment Alias (All Qualified) \odot Members with Current Reservations \odot Supervsers	
	Send Cancel	

Figure 34. Equipment e-mail form

The equipment e-mail form will be open in the new window. A member needs to write a subject and a message, choose the group of members whom this message will be addressed, and press Send button.

4.5.3 Buddies

To find a buddy to work together in the laboratory, a member may send a broadcast message to other members using the Buddies option.

This option is available at MercuryWeb.

To send a broadcast message, a member needs to click on <u>Buddies</u> link at the Activity section on the Member page.

	Marvell Nanofabrication Laboratory University of California, Berkeley		4.0 build(20160128)
Member			Logout
Activity	Equipment	Qualific	ations
Reservations	All Equipment Status	My Qualifications	
LabHist	Engineers/Keyops	By Equipment	
Labwho	EMail equipment	By Member	
Suggestions	Enabled equipment	Requalify	
All Problem Status Board	Manuals	Qualification Test	
Buddies	View Header	Qualification Rules	
Available Equipment Tests	Request Qualify	Facility Safety Test	
Member Information		Proc	ess
Member Gallery	Lab Materials	Problem History Se	arch
Staff Gallery	Chemicals	Parameter History	Search
Find Members		Mask Request	
Recognitions	Machine Shop	Quality Monitor Lis	<u>t</u>
Safety Incidents			
Suspended Members			

Figure 35. Buddies link

Buddies will be open in the new window.

()	Marvell Nanofabrication Laboratory University of California, Berkeley 4.0 build(2018012						
Member							Logout
Join List Leave Li	st	Messages History				Message	
Member		Message	Sender	Date			
abwong	*	Anyone coming in tomorrow		Feb 5,	^		
ajcukier	Ξ	Feb 6 at ~9 or 10am? I'll be there running a dep.	timassey	2016 6:04:49 PM	-		
ajparker	_	Is anyone coming in this		Jan 17,			
alseddiq		morning between 9-12 or this afternoon between 2.72	ajparker	2016 8:26:27 AM			
amani		Anyone today or tomorrow		lan 2, 2016			
angada		(am and/or pm)?	chamanza	9:38:03 AM			
atoor		anyone working this Sunday		Dec 19,			
baolwei3		12/20/15 from 5pm-midnight	saechao	2015 3:06:33 PM			
bill				Nov 27.			
ceballos		Anyone coming in this morning?	fabian	2015			
cescjul				8:44:01 AM			
chamanza		Is anyone coming to lab		Nov 21,			
csherman		now?	xiay07	2015 9:34:33 AM			.11
dlhilken	-	Te anyone planning on		Nov 7	-	Send	
		(Back				

Figure 36. Buddies option

A member needs to text a message at Message text field and press on Send button. The message will be sent to all members listed in the Member window and will appear in the Message History window.

To get e-mails from Buddies, a member needs to join Buddies listing by clicking on Join List button.

To stop receiving e-mails from Buddies, a member needs to press on Leave List button.

4.6 Equipment Override

To perform *Mercury System* updates and maintenance with as little effect on members that are working in the cleanroom as possible, there is Equipment Override procedure.

Equipment Override doesn't affect member's work if an equipment is already enabled or it is reserved for that time frame.

During Equipment Override procedure all equipment will be automatically enabled.

After Equipment Override is turned off, all equipment will be automatically turned off except of:

- 1. Equipment that was enabled before Equipment Override was turned on,
- 2. Equipment that was enabled at Mercury Client during Equipment Override, and
- 3. Equipment that had reservations for that time frame.

Keep in mind

If a member wants to keep an equipment on after Equipment Override will be turned off then they need to enable the equipment at *Mercury Client* before Equipment Override will be turned off.

When the laboratory staff members plan to turn on/off Equipment Override they send a broadcast notification about it to everybody who is in the cleanroom. This notification is displayed on the TV screens located in the cleanroom and in the NanoLab office. Also all members will be notified about it by e-mail and by phone via broadcast pager system, so members will hear this message from all NanoLab phones and speaker in the cleanroom.

5.0 Appendices

1. Equipment Problems Reporting

Action	Recipients
New Report, Update or Maintenance	Keyops, Process and Equipment Engineers, and Members with reservations
Fix	Keyops, Process and Equipment Engineers 1 and 2, and Active Members with current or expired qualifications
Delete	No Emails

2. Reservation Rules

Action	Restrictions
Reserve	At least half an hour (up to one hour) in the future.
Delete reservation by member	Not allowed to delete past and in progress reservations
Delete reservation by staff	No restrictions

3. Suggestion Email

Action	Recipients
New	bill, bob, marylin, member
Update	

4. Safety Incident Email

Action	Recipients
New	nanolab (all members)

5. Recognition Email

Action	Recipients
New	bill, bob, marilyn, member, nominee
Update	member

Action	Equipment Status	Restrictions
Enable	Green	No restrictions
	Yellow	No restrictions
	Red	Staff only
	Cross	Staff only
Disable	Green	No restrictions
	Yellow	No restrictions
	Red (enabled by member)	No restrictions
	Red (enabled by staff)	Staff only
	Cross (enabled by member)	No restrictions
	Cross (enabled by staff)	Staff only

6. Equipment Enable/Disable Rules

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