NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

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Ref: CINTRA/SOP/015.00	Date of issue: 05 Dec 2019	Next review date: 04 Dec 2022
Title :	Standard Operating Procedures on Maintenance of Critical Equipments in CINTRA	
Audience :	Users of Critical Equipments in CINTRA	

1. Aim

This SOP details the procedures of maintenance of 2 critical equipments in CINTRA to ensure continuous working condition of the equipments and to prevent any disruption to the research activies. The two critical equipments are namely:

1) Femtosecond Laser (located at Photonics Lab)
2) Picoquant Laser (located at Characterisation Lab 1)

2. Scope

This SOP only covers the procedures of maintenance for the two critical equipments in CINTRA. As for detailed procedures for running the equipment, one should refer to the respective equipment manual.

3. Roles and Responsibilities

3.1 Laser-staff-in-charge

3.1.1 Each laser-staff-in-charge is responsible to implement the procedures as outlined in this SOP and report any changes to the CINTRA Safety Committtee.

3.2 Equipment users

3.2.1 Critical equipment users must obtain N3 laser license before commencing work using the critical equipment.

3.2.2 Critical equipment users must read and understand this SOP and also adequately trained in using the equipment before starting to carry out any experiments using the critical equipment.

4. Procedures of Maintenance of Femtosecond Laser

4.1 Dehumidifier is used to lower down the environmental humidity. As there is no drain in the lab, dehumidifier must be cleared daily to ensure its continuous operation.

4.2 Before turning on the system:
(a) Safety laser lights outside the lab must be turned on.
(b) Curtains must be closed,
(c) Take off any reflective items, e.g. watch, ring, staff card, etc.

4.3 During system operation:
(a) Safety googles must be worn whenever the laser shutter is open.
(b) If changing of setup (eg, adjustment of laser power or alignment) is required, make sure the shutter of the laser is closed before doing any adjustment.

4.4 After operation:
(a) Laser output power must be set to minimum.
(b) Shutter must be closed.
(c) Key of the laser on the front panel must be turned to StandBy.
(d) Safety glasses must be returned to original storage location.
(e) Lab safety laser light outside must be turned off.
(f) Regular maintenance is recommended to be done by professional engineer from vendor, usually once a year, if there is enough financial support.

5. Procedures of Maintenance of Picoquant Laser

5.1 To prolong the lifetime of the laser's inner optical components, the vendor has recommended to maintain the surrounding humidity level to be below 60%. To ensure humidity level below 60%, a dehumidifier has been installed and kept on at all times. To ensure continuous 24/7 running of the dehumidifier, the following procedures should be adopted:
(a) Humidity setting should be set to 55%.
(b) Curtains around optical table must be closed tightly even if the optical table is not in use.
(c) If the optical table is in use, turn off the dehumidifier to avoid overworking it.
(d) The water drainage tube must be installed at all times on the dehumidifier water outlet and brought to the hole on the floor.
(e) The tube end which is connected to the water outlet must be secured very tightly at all times to avoid leakage and filling up of the water tank. When the water tank is full, the dehumidifier will automatically turn off.
(f) If the water tank is full, immediately pour out the water tank at the nearby basin, install back the water tank, turn the dehumidifier back on and report to lab staff-in-charge.
(g) Before or after using the optical table, users should check the humidity level and report to lab staff-in-charge for any abnormal reading.
(h) Users must not tamper with the water drainage tube connections to prevent leakage problem.

5.2 No untrained person should be allowed to operate the Picoquant laser. To qualify as a user, one must have a valid N3 license and be qualified by laser staff-in-charge.

5.3 During operation, the curtain has to be closed completely. This is to prevent the laser beam from going out from the optical table and the photodetectors in the equipment are very sensitive to light.

5.4 After operation, all electrical connections must be turned off. This is also a precaution to prevent the lasers and photodetectors still being turned on when the curtain is opened.

6. Frequency of maintenance

Since manufacturers recommend a yearly maintenance procedure, laser-staff-in-charge will conduct regular maintenance once a year and record it in 2 documents: one document for the individual laser and one consolidated document titled “Laboratory and Workshop Equipment Maintenace List”. The templates for respective equipment are attached as appendix at the end of this SOP.

7. Maintenance Matrix and priority number (PN)

With reference to NTU SOP of Maintenance of Equipment, NTU/OHS/SOP/15.3 the Femtosecond Laser (located at Photonics Lab) and Picoquant Laser (located at Characterisation Lab 1) are classified as PN 3. There is limited risk to personnel in case of failure. Preventive maintenance can be carried out by laser-staff-in-charge.

8. Maintenance versus checks

Check: Every user is required to visually inspect the general condition of the laser before each use. Any abnormal situation should be reported immediately to laser staff-in-charge.

Maintenance for Femtosecond and Picoquant lasers: Laser-staff-in charge will regularly operate the laser under nominal conditions in order to ensure all devices (pumps, laser, and safety equipment) are all functional. If any part is missing or defective the equipment will be banned from access until all operational conditions are back to normal.

9. Documentation

Each user is required to fill the log book with operating conditions and mention any abnormal operation.

Laser staff-in-charge must regularly check the log book and request a maintainance process if necessary.

Laser staff-in-charge should fill their respective Maintenance Record (Appendix 2 & 3) whenever maintenance is performed.

The Laboratory & Workshop Equipment Maintenance List should be filled at the end of each calendar year to provide an overall view of the maintenance level of the two critical equipments.

Experimental conditions records should be kept to allow reproducibility of experiments and observe any drift.

Maintenance records should be signed and archived until equipment is obsolete.

Version History

This Table below reflects the summary of changes made to the document. The full change information is indicated with yellow highlight in the document content.

Revision	Section	Details of Change	Document Author	Effective Date	Approved By
00	N.A	Initial Release	Dr Mohamed Boutchich	05 Dec 2019	Dr Dinh Xuan Quyen

Appendix 1 - **Laboratory & Workshop Equipment Maintenance List**

School/department: CINTRA date:
Prepared by:

Lab/Workshop equipment	Location	Maintenance classification level (1 to 4)	Frequency of maintenance	Date of last maintenance	Next scheduled maintenance date	Maintained by	remarks
Femtosecond laser	Photonics lab	3	Once a year				
Picoquant laser	Charac lab 1	3	Once a year				

Appendix 2 – Maintenance Record for Femtosecond Laser at CINTRA

Maintenance classification level: 3
Frequency of maintenance: once a year

Date of maintenance	Next scheduled maintenance date	Maintained by	remarks

Appendix 3 – Maintenance Record for Picoquant Laser at CINTRA

Maintenance classification level: 3
Frequency of maintenance: once a year

Date of maintenance	Next scheduled maintenance date	Maintained by	remarks