MME Standard Operating Procedure (SOP)

Name	• Huys ESD Machine #2
Description	• R&D Variable Parameters ESD Machine
Location	• E3-2107 “Welding Lab”
SOP Creation Date	• 2015-3-31
SOP Created By	• Foss Jiao, Dominic Leung
SOP Revision Date	•
SOP Revised By	•
SOP Location	• inv.mme.uwaterloo.ca
Manual Location	• E3-2107 “Welding Lab”
Equipment Owner	• Professor Norman Zhou (x36095) & Huys Industries
Authorized Trainers	• Joyce Koo, Foss Jiao, Stephen Peterkin and Dominic Leung
Support Technicians	• Dominic Leung

Significant Hazards	• Light
	  ○ Weak UV radiation from the electrode sparks
	  ○ Weak UV radiation from red hot metals
	• Burns
	  ○ Operating electrode tips reach red hot temperatures
	• Fumes
	  ○ Some metals may be rapidly oxidized or vaporized during deposition forming toxic vapors
	• Vibrations
	  ○ Vibrations from the applicator would cause bodily fatigue after an extended period of operation
	• Noise
	  ○ Extended use of depending on the applicator can cause hearing damage

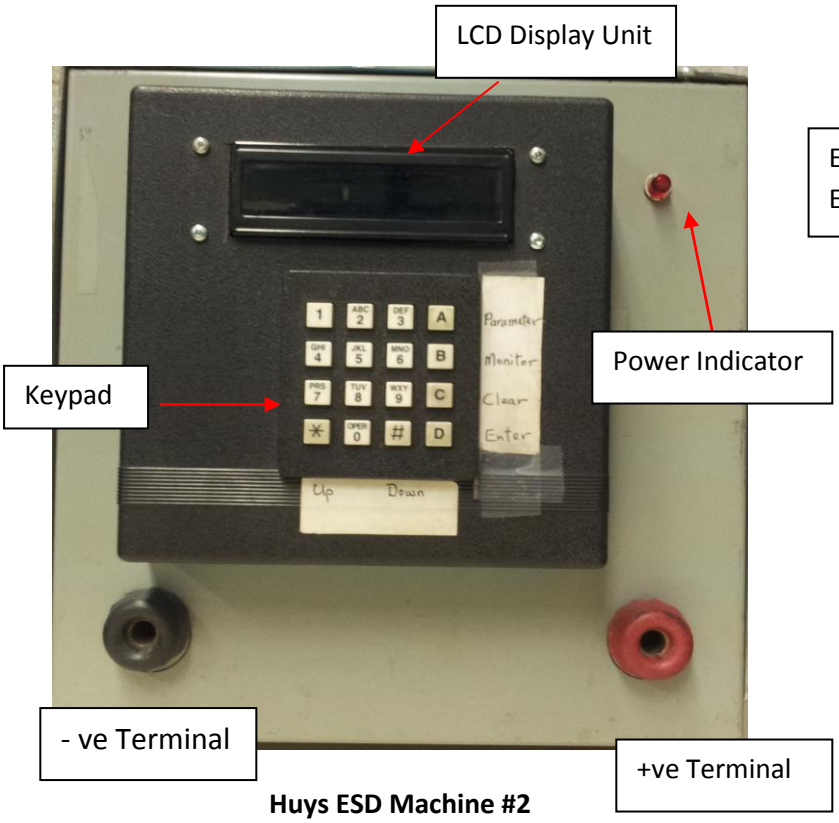
Administrative Controls	• Scheduling of ESD depositions shall be scheduled amongst the authorized personnel • Only authorized personnel shall operate, maintain or service the ESD Machine • Reduce extended depositions to prevent fatigue, eye damage and hearing damage • Always run the lab ventilation fan when depositing
Engineering Controls	• Equipment design prevents excess large short circuit discharges while the applicator is not rotating / vibrating • Equipment discharge and resistance requirements prevents electrocution during operation

PPE Required	Typical operating procedures and papers on ESD stress that there are little to no required PPE requirements
	• Eye protection is required during ESD
	  ○ Clear safety glasses are the minimum to spectate the ESD equipment
	  ○ Operators should use tinted safety glasses or brazing goggles during extended ESD use, as the bright sparks and weak UV radiation may strain eyes
	  ○ Shades beyond 5 may impair vision during deposition and are not recommended
	• Gloves are to be worn to protect from sparks during deposition as well as prevent burns from handling hot substrates and electrodes post deposition
	• Long sleeves or lab coats are required to protect wrists and arms from sparks and burns resulting from deposition and contact with hot substrates / electrodes
	• Hearing protection can be used if loud applicators are being utilized for extended periods of time

Relevant Standards and Codes	• none
Relevant MSDS	All MSDSs can be found at msds.mme.uwaterloo.ca • Argon Compressed gas • LECO diamond spray

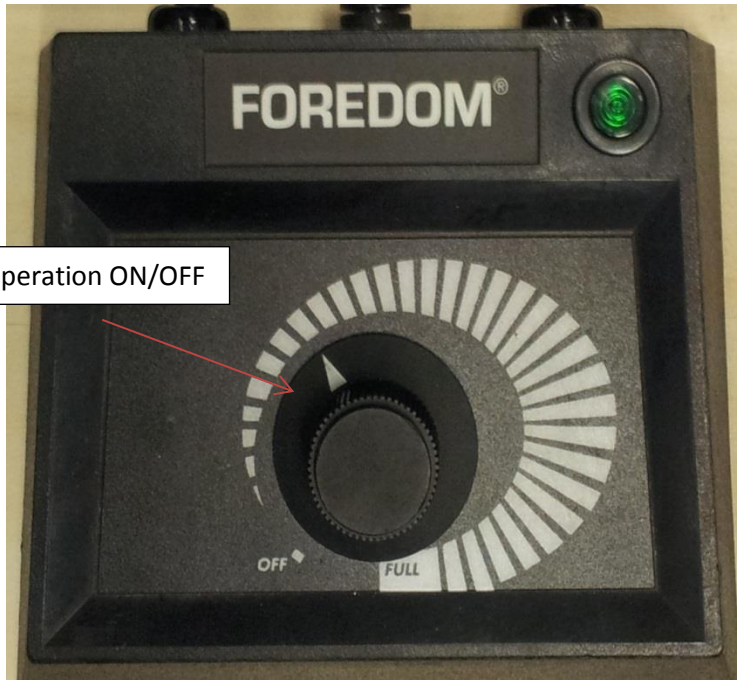
Accident Procedure	• All accidents are to be reposted to the supervisor as soon as possible
	  ○ Treat minor incidents with First Aid kits or contact UW Health services 599-888-4096 x84096
	  ○ Contact Dr. Joyce Koo or Professor Norman Zhou
	  ○ Complete incident report
	• In the event of serious injury / illness Call 911
	  ○ Also contact campus police services 519-888-4911 or x22222
	  ○ Complete incident report

Emergency Shutdown Procedure	• Injury
	  ○ Turn off the Huys ESD Machine using the power ON / OFF switch
	  ○ Follow accident procedure
	  ○ Complete incident report
	• Fire
	  ○ Turn off the Huys ESD machine if safe to do so
	  ▪ Disconnect the power to the machine if safe to do so and necessary
	  ▪ Turn off the exhaust fan to the lab if safe to do so
	  ▪ Exit the area and assemble outside as stated in the Building Emergency Plan
	  ▪ Access fire extinguisher if the fire is small enough
	  ▪ Fire extinguisher located on the wall in the corridor outside the lab
	  ▪ Activate wall mounted fire alarms
	  ▪ Report any information about the fire to the UW Police and Fire Department



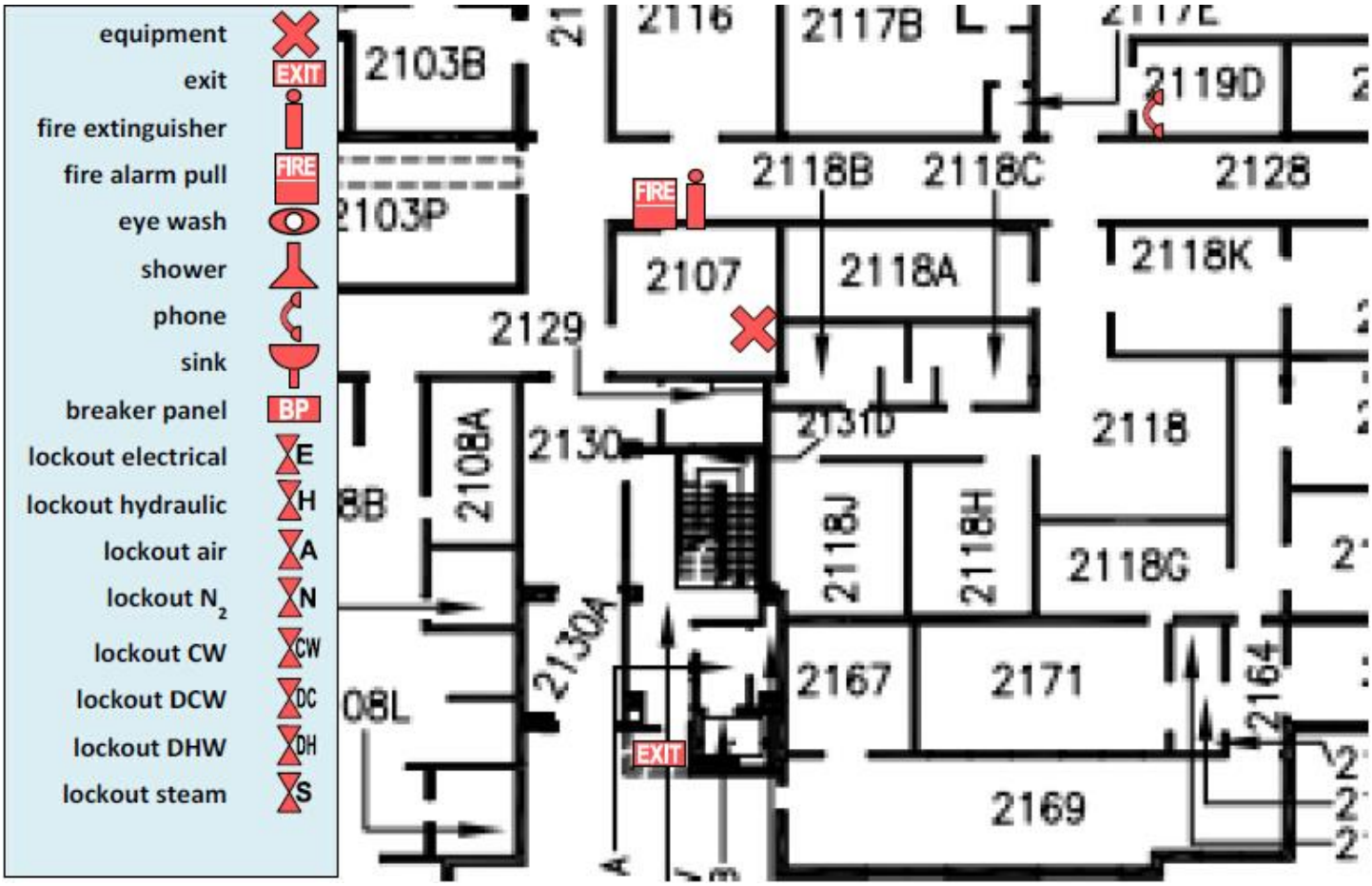
Huys ESD Machine #2

Huys Applicator



Spindle Speed Control

Applicator Speed Control



Pre-start Checklist

- Ensure that the lab ventilation fan is on
- Ensure that the door to the lab is closed to protect passers by
- Ensure that the deposition area is clear of flammable media and clutter
- Check the operating condition of the equipment
  - Check the machine power, applicator and grounding cables for fraying and damage
- Do appropriate PPE as listed in the operating procedure
  - Ensure that the operator will not contact the fixtures, ground, substrate or electrode while operating with bare skin
- Ensure that a power bar is securely connected to the wall outlet 15A 120V 60hz
- Ensure that the power switch of the applicator speed control is set to OFF
- Ensure the power switch of the power bar is set to OFF before the ESD machine, the spindle speed control & applicator speed control units are connected to the power bar
- Ensure the spindle unit securely sits on a bench, and is free and safe to rotate
- Ensure that the applicator speed control unit is securely mounted to a wall
- Ensure that a ground cable is securely connecting the –ve terminal of the ESD machine and the terminal of the spindle unit
- Ensure that the ESD power cable from the applicator is securely connected to the +ve terminal of the ESD machine
- Ensure that the cooling fan is operating when the power is ON

Start-up Procedure

- Attach the applicator and ground clamp before turning on the machine
- Ensure that the power bar is securely connected to the wall outlet 15A 120V 60hz
- Ensure that the ESD machine, spindle speed control unit and the applicator speed control unit power cables are securely connected to the power bar
- Attach an electrode cap, to be ESD coated, to the spindle unit
- Secure an ESD electrode into the applicator (may require the use of a hex key to the holder)

Operating Procedure

- Turn on the power bar (Ensure that the applicator speed control switch is set to OFF)
- Turn on the ESD machine. Ensure the LCD display shows a normal power up sequence
- Ensure the following ESD parameter values for normal coating conditions with the use of the keypad and LCD display units on the front panel: (Find detailed information in user manuals)
    - ARC Voltage = 5 - 45, default = 20
    - ESD Voltage = 25 - 45, default = 35
    - ESD Voltag2 = 10 - 45, default = 20
    - ARC Charge = 10 - 35, default = 25
    - ESD Charge = 10 - 45, default = 40
    - Discharge DLY = 0 - 5, default = 1
    - Recharge DLY = 0 - 5, default = 2
    - Hi Pulse = 1 – 5, default = 2
    - Lo Pulse = 0 – 5, default = 2
    - Cntrl Mode = 0 – 5, default = 1
- Ensure that the electrode cap on the spindle is rotating in a symmetrical manner. Redo the sitting if necessary
- Set the spindle speed control to desired value and ensure that the spindle is spinning freely
- Set the power switch of the applicator speed control device to the desired rotational direction, FWD or REV. The applicator should start vibration immediately.
- Begin deposition
- Adjust ESD coating parameters when needed through the keypad and LCD display units on the front panel

Shutdown Procedure

- Turn off the ESD machine
- Turn off the FWD/OFF/REV switch of the applicator speed control unit
- Carefully place the applicator where the electrode will not damage any of the equipment or fixtures (as it remains hot after deposition)
- Turn off the ON/OFF switch of the power bar

Maintenance and Repair

- Clear the dust collected on the filter screens on the side of the chassis
- Contact Dominic Leung or other trained staffs for serious problem and electrical issues