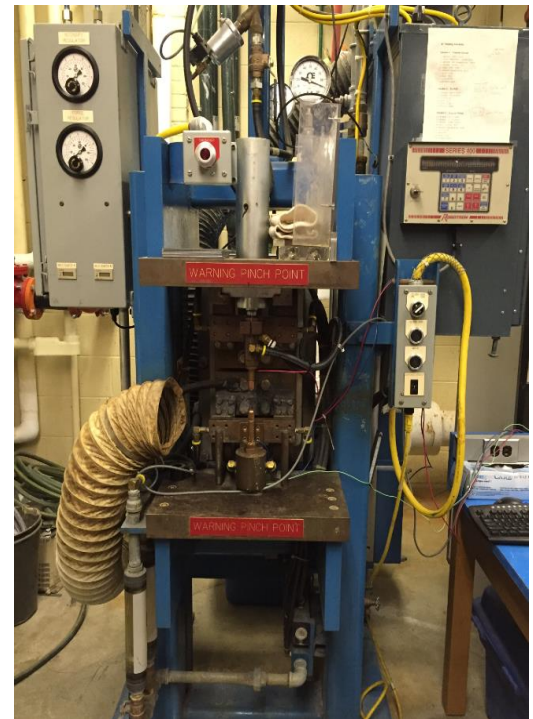


MME Standard Operating Procedure (SOP)

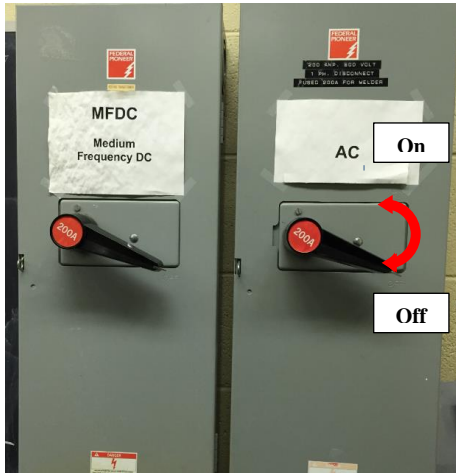
Name	<ul style="list-style-type: none"> AC Resistance Spot Welding Machine
Description	<ul style="list-style-type: none"> description of procedure or equipment
Location	<ul style="list-style-type: none"> E3-2118J "Resistance Spot Welding Lab"
SOP Creation Date	<ul style="list-style-type: none"> 2015-10-9
SOP Created By	<ul style="list-style-type: none"> Dongwoon Huh
SOP Revision Date	<ul style="list-style-type: none">
SOP Revised By	<ul style="list-style-type: none">
SOP Location	<ul style="list-style-type: none"> inv.mme.uwaterloo.ca
Manual Location	<ul style="list-style-type: none"> E3-2118J
Equipment Owner	<ul style="list-style-type: none"> Prof. Norman Zhou (x.36095)
Authorized Trainers	<ul style="list-style-type: none"> Current: Dongwoon Huh (x.33326)
Support Technicians	<ul style="list-style-type: none"> James Merli E-mail: jhmerli@uwaterloo.ca Tel: 519-888-4567 (x38080) Location: E3 2103F



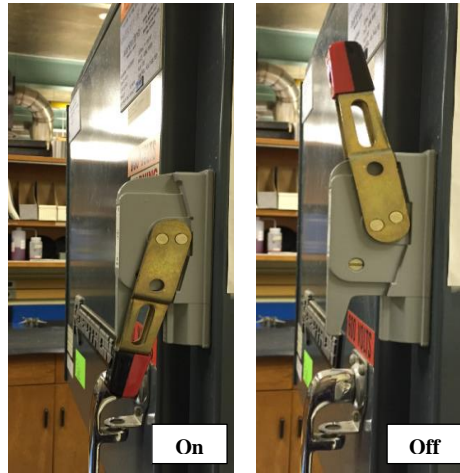
Significant Hazards	<ul style="list-style-type: none"> Eyes and Skin hazard <ul style="list-style-type: none"> AC Resistance Spot Welding(RSW) will make ejection of hot molten metal during weld Fumes hazard <ul style="list-style-type: none"> Some materials may generate toxic fumes by melting in high temperature during weld High pressure hazard <ul style="list-style-type: none"> the high electrode welding force which is made from hydraulic system can make injury on your finger or hand Electric hazard <ul style="list-style-type: none"> The RSW machine requires special care in handling because it uses high voltage and current from transformer
Administrative Controls	<ul style="list-style-type: none"> If someone who wants to use the RSW machine is, the logbook should be written by the real user (day, time, sign) you must indicate who and when the equipment can be used <ul style="list-style-type: none"> can only be used by the person who got an appropriate training about the AC machine Authorized person: Dongwoon Huh (x.33326) Personal protective equipment such as protective glasses, lab coat, safety boots, gloves, etc., should be prepared before running the test

Engineering Controls	<ul style="list-style-type: none"> • According to the user’s base material, welding parameters (cycles, current, pressure) should be found during the preliminary test • An Emergency Stop button in front of the machine (Red Button) • During operation, operator should follow the standard operating procedure as written in the manual. • DAQ system requires special care in handling such as line connection and operating condition
PPE Required	<ul style="list-style-type: none"> • Operators should be equipped with protective equipment to protect from spatter or splash. <ul style="list-style-type: none"> ○ <i>protective glasses, lab coat, gloves, etc.</i> • Only the person who got the safety training through the on-line can operate the AC RSW machine
Relevant Standards and Codes	<ul style="list-style-type: none"> • Occupational Safety And Health Administration (OSHA). Code of Federal Regulations, Title 29 Labor, Parts 1901.1 to 1910.1450 • American National Standards Institute (ANSI). Safety in Welding, Cutting, and Allied Processes (ANSI Z49.1) • National Fire Protection Association (NFPA). National Electric Code (NFPA 70) • Canadian Standards Association (CSA). Safety in Welding, Cutting and Allied Processes (Standard W117.2) • American National Standards Institute (ANSI). Practice for Occupational and Educational Eye and Face Protection (ANSI Z87.1) • National Fire Protection Association (NFPA). Standard for Fire Prevention During Welding, Cutting and Other Hot Work (NFPA 51B)
Relevant MSDS	All MSDSs can be found at msds.mme.uwaterloo.ca
Accident Procedure	<ul style="list-style-type: none"> • Response/Reporting procedures • All accidents/exposures are to be reported to supervisor as soon as possible. Serious Injury/ Illness: Eye injuries, skin injuries • Call 911 or proceed immediately to the UW Hospital Emergency Department. • Compressed air/argon/oxygen leakage from cylinder → Call UW Police 519-888-4911 or X. 22222. • All Other Injuries • For treatment of all other injuries, proceed to: <ul style="list-style-type: none"> ○ Department/Residence → first aid kit / station location → E3 – 2108H ○ Health Services → first aid services available → 519-888-4096, X. 84096 ○ UW Police → assists if the above services are not available → 519-888-4911, X. 22222. • Also see safety posters in the lab

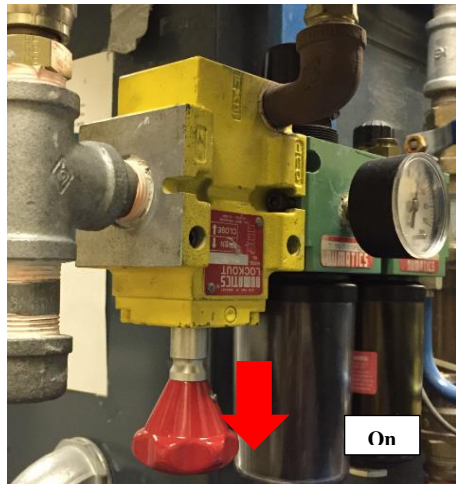
Emergency Shutdown Procedure	<ul style="list-style-type: none">• Personnel Injury:<ul style="list-style-type: none">○ Turn off the laser system with the "Emergency Button" or power switch.○ Call 911 and inform the dispatcher to advise medical personnel that the accident involved lasers.○ Contact Health Services – first aid services available → 519-888-4096 or Ext. 84096.○ UW Police – assists if the above services are not available → 519-888-4911 or Ext. 22222.○ Complete incident report.• Fire:<ul style="list-style-type: none">○ Turn off the laser system with the "Emergency Button" or power switch.○ Evacuate area as stated in your Building Emergency Plan.○ Active wall mounted fire alarm pull station located at exits.○ Call 911 for medical assistance (Ambulance). If using a cell/mobile call UW Police at 519-888-4911.○ Report any information about fire to UW Police and Fire Department.
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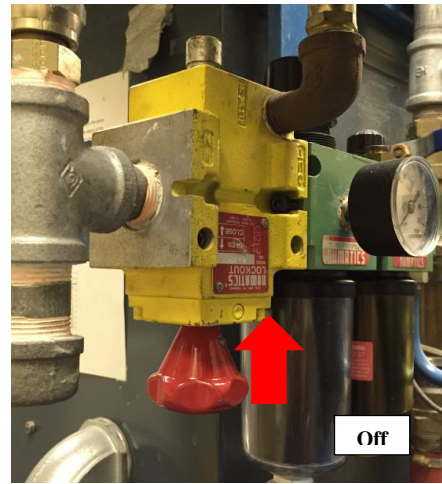
1. Main Transformer Switch



2. Welding Controller Switch



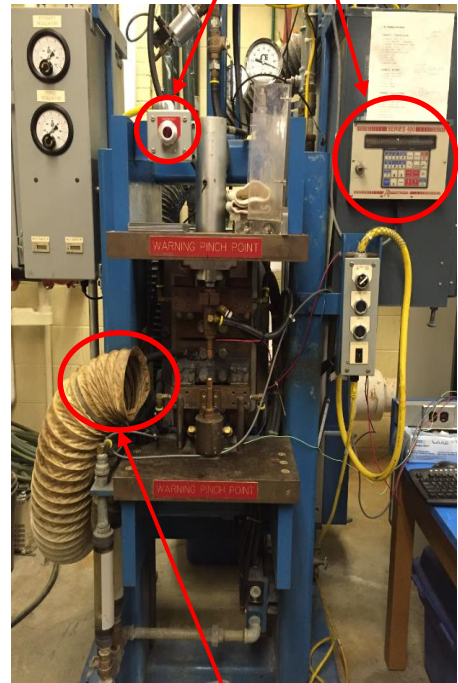
3. Welding Pressure Valve



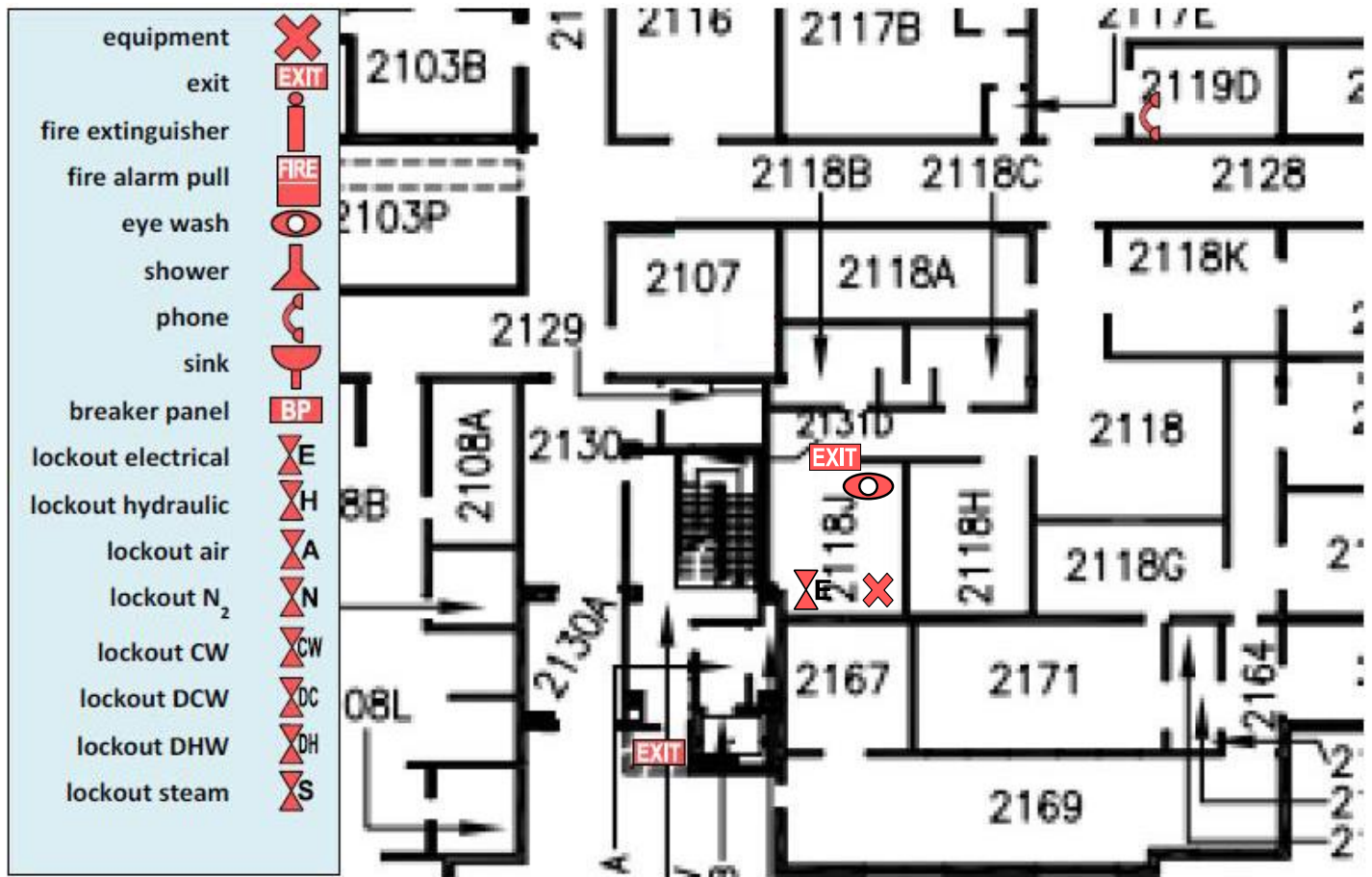
4. Cooling Water Valve

5. Welding Controller

6. Emergency Button



7. Fume Collector



Pre-start Checklist

- Ensure that the AC RSW machine area is clear of flammable or chemical liquid
- Check the operating conditions of the equipment
 - Main power switch, cooling water switch, fume collector and pressure switch
- Check the DAQ system condition
 - Power switch On/Off, connecting condition (current coil, voltage line, pressure line)

Start-up Procedure

The following items need to be ensured before Resistance Spot welding operation:

- The workplaces should be cleaned after each operation
- Check the operating system is working well by doing preliminary test in low current, low pressure and short welding time
- Check the acquired welding signal

Operating Procedure

- 1) Wear protect glasses, gloves and lab coat
- 2) Turn on the AC transformer switch
- 3) Turn on the controller power
- 4) Open the cooling water valve
- 5) Pull the pneumatic valve downward to open
- 6) Check the front control panel and find any error message
- 7) Push the NO WELD button on the control panel
(Turn on the RED light)
- 8) Set up the welding variables
(Turn the 'KEY' switch to PROGRAM)
- 9) If got any unsolved error message on controller display, refer to the manual book or contact to the trainer
(It might be needed an initial set up work)
- 10) Check the electrode tip condition
(If the electrode tip's condition is bad, should be changed to new one)
- 11) Turn the 'KEY' switch to weld
- 12) Check the alignment of the upper electrode and lower electrode with switching on the CLOSE GUN
- 13) Schedule select dial's number and the made welding program number should be same
(If the number is different, the real welding will be followed the dial's number)
(Don't turn the dial switch to '0',Zero, and Do not weld in this condition)**
(Check again before the welding)
- 14) Regulate the welding pressure by using the pressure dial
(This work will be needed an welding pressure gauge)
(If you needed to use the gauge, contact to Dongwoon)
- 15) The 'NO WELD' button should be turned on when you calibrate the welding pressure
(If you calibrate the welding pressure on welding, the pressure gauge will be out of order)
(All of the responsibility for the pressure gauge are on the user)
- 14) Start welding
(If the weld has made a spatter or splash, the welding condition should be changed to lower than before)
- 15) Check the temperature of the electrode tips
(The electrode tips should be kept low temperature before the welding)
(If you weld continuously, you have to check the electrode tip's temperature frequently to prevent the sticking between electrode tips and the base materials)
- 16) Turn off the cooling water switch when you want to change the electrode tips
(Needed tool: Vise plier)
(Should be handled carefully because the electrode and tips might be deformed by the excessive force)
- 17) Turn on the 'NO WELD' button and turn the KEY switch to 'PROGRAM' whenever you want to change the value of welding variables
- 18) After finish the weld, all switches should be turned off and cleaned up around the AC RSW machine
- 19) Turning off the main power switch is difficult to move. So, please handle with wearing gloves
- 20) Test specimens which finished welding should be marked on the surface, and keep in a box safely.

Shutdown Procedure

- Turn off the RSW machine's switches
 - Pneumatic pressure valve, cooling water valve, controller power and main power switch in order
- Back-up DAQ welding signal data
- Turn off the computer

Clean-up

The clean-up procedures are as follow:

- Clean up the working table after weld; any kind of water, weld specimens and tools
- Scrap metal should be disposed properly. (Separate steel from other metals)

Maintenance and Repair

The following procedure must be followed during maintenance and repair:

- Check the RSW machine's part condition regularly
- Refer to the manual during the maintenance/repair
- Contact to Centerline as below information or other trained staffs for serious problems and electrical issues
 - Company: Centerline
Address : CenterLine (Windsor) Limited 415 Morton Drive Windsor, ON N9J 3T8 Canada
Service Tel.: 519-734-0080
E-mail: service@cntrline.com
Website: <http://www.cntrline.com/>