

Name of SOP	Resistance Heating and Mechanical Testing (RHMT) System for room temperature and hot clinching experiments										
Effective Date	February 21st 2018										
Author	Mukesh Jain										
Reason for SOP	<p>Check All that Apply:</p> <table border="0"> <tr> <td><input checked="" type="checkbox"/></td><td>Procedure/Process could cause critical injury.</td></tr> <tr> <td><input type="checkbox"/></td><td>Procedure/Process could cause occupational illness.</td></tr> <tr> <td><input type="checkbox"/></td><td>Procedure/Process could cause environmental impairment.¹</td></tr> <tr> <td><input checked="" type="checkbox"/></td><td>Procedure/Process could damage University property</td></tr> <tr> <td><input type="checkbox"/></td><td>Not critical, but requesting a review</td></tr> </table> <p>Provide Details:</p> <p>-Accidental (unintended) actuator motion can cause injury to person and equipment.</p> <p>- High currents are involved and can cause injury to person and equipment.</p> <p>-High pressure in the fluid lines for hydraulic loading of test samples. The lines can leak and fracture if the pressure is exceeded.</p>	<input checked="" type="checkbox"/>	Procedure/Process could cause critical injury.	<input type="checkbox"/>	Procedure/Process could cause occupational illness.	<input type="checkbox"/>	Procedure/Process could cause environmental impairment. ¹	<input checked="" type="checkbox"/>	Procedure/Process could damage University property	<input type="checkbox"/>	Not critical, but requesting a review
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Approved by (supervisor)											
Date reviewed by JHSC	Feb. 14, 2018										
Date Last Reviewed	Feb. 21, 2018										

Definitions

Terms	RHMT – Resistance Heating and Mechanical Testing
Acronyms	RMM – Risk Management Manual JHSC - Joint Health and Safety Committee EOHSS - Environmental and Occupational Health Support Services EPA – Environmental Protection Act OHSA – Occupational Health and Safety Act

Requirements

Applicable OHSA regulations and / or codes of practice. <ol style="list-style-type: none"> 1. RMM #101 - McMaster University Risk Management System 2. RMM #102 – Occupational Health and Safety Act (OHSA) code.
Training and Competency Supervisor will ensure that adequate training is provided to any user of this equipment by the technical staff.

Description of the Task

Location and time of work	JHE 314, as required by testing needs
Individuals involved	Post-doctoral researchers, graduate students
Equipment and supplies required	<ol style="list-style-type: none"> 1. Mechanical loading system 2. Electrical heating system (welder/transformer) 3. Hydraulic pump and cooling system 4. Data acquisition computer 5. Control box
Personal protective equipment required	<ol style="list-style-type: none"> 1. Safety eyewear 2. Class D fire extinguisher in JHE314 <p>There is no plan to carry experiments with Mg.</p>

Sequential Steps to Complete the Work Safely

Pre-Start Up:

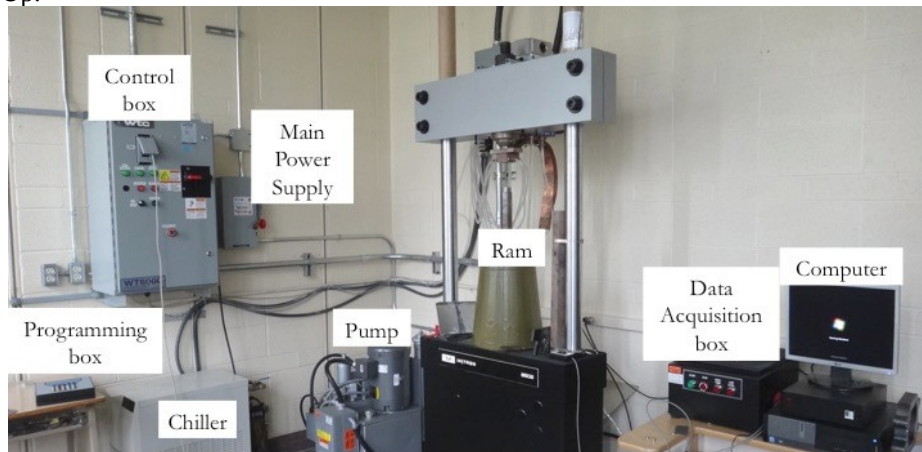


Figure 1: Overview of the equipment layout.

1. Inspect the machine for any damage arising from excessive loading, damage to any fixtures, excessive wear etc.
2. Switch on the main power supply (Figure 1)
3. Switch on the control box (Figure 2)



Figure 2: Control box with various switches.

4. Turn on the computer and the data acquisition box.
5. Turn on actuator hydraulics (Figure 3)



Figure 3: Control box for the hydraulic system with various switches.

5. Turn on chiller (Temperature: 17-31 °C)
6. Open the software “Mtest Module”
7. Set the load limit on the machine using the software.
8. Under ‘acquisition’ in the menu, zero the load on unloaded load cell (Figure 4)

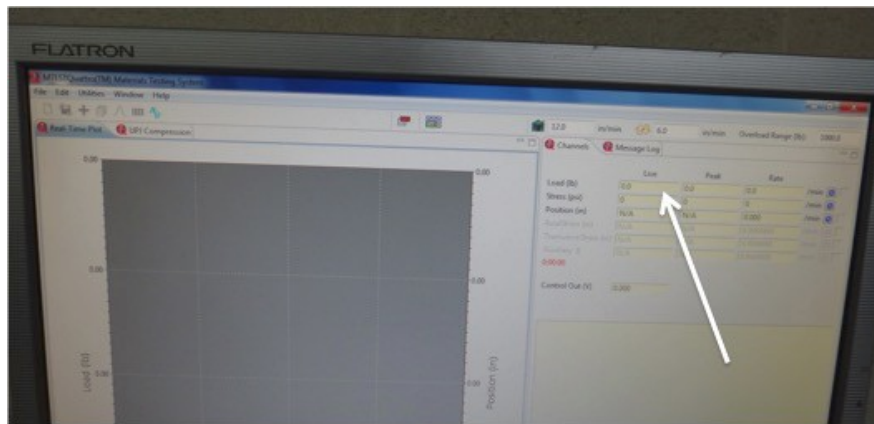


Figure 4: Computer interface to set the pre-load value to zero.

9. Under ‘test procedures’ in the menu, select ‘Clinching Test’
9. Under ‘profile’ menu and ‘servo-control’ sub-menu, program the mechanical loading segments as required while ensuring that load limits are not exceeded.
10. Inspect the punch and anvil for cleanliness and damage and then install them as in Figure 5 below.

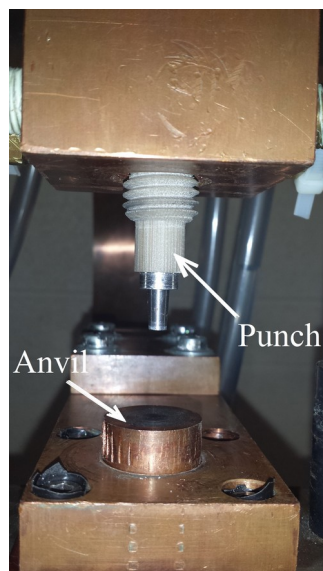


Figure 5. Punch and flat anvil installation for die-less clinching experiments.

11. Install the sliding electrodes (8 of them and blank holder as in Figure 6).

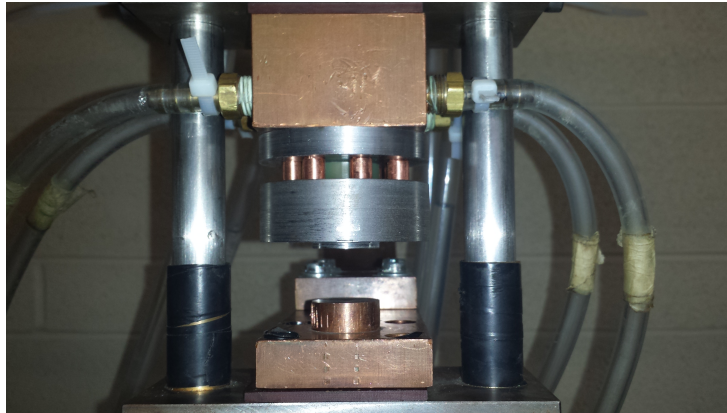


Figure 6. Installation of blank holder with electrodes.

12. Position the two sheets between the anvil and the blank holder (Figure 7)

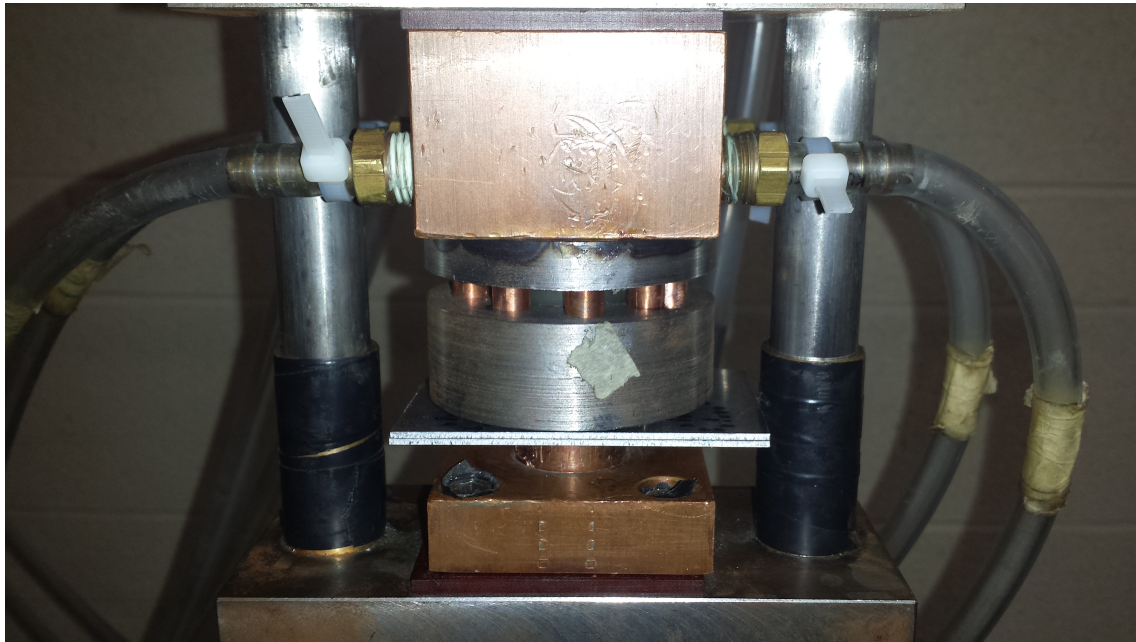


Figure 7: Sample (pair of sheet materials) placement between the anvil and the blank holder.

13. In the programming box, under program mode, select 'review schedule' by clicking F1 (Figure 8). Input the electrical heating profile in the program ensuring that applied current limits on the resistance heating system of 15 kA is not exceeded.

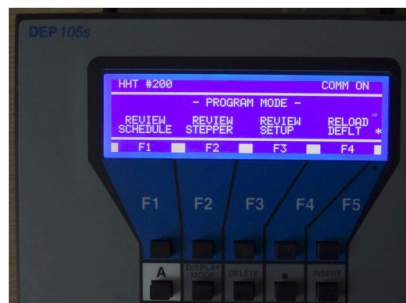


Figure 8: Programming box to input electric heating profile.

14. The machine is now ready to do the tests. Click 'initiate weld' button on the control box (Figure 9).



Figure 9: Turning on the resistance heating module from the Resistance heating control box to start the test.

15. At the end of the test pull down the flat anvil to take out the specimen using high temperature gloves as the specimen may still be hot to the touch (Figure 10)

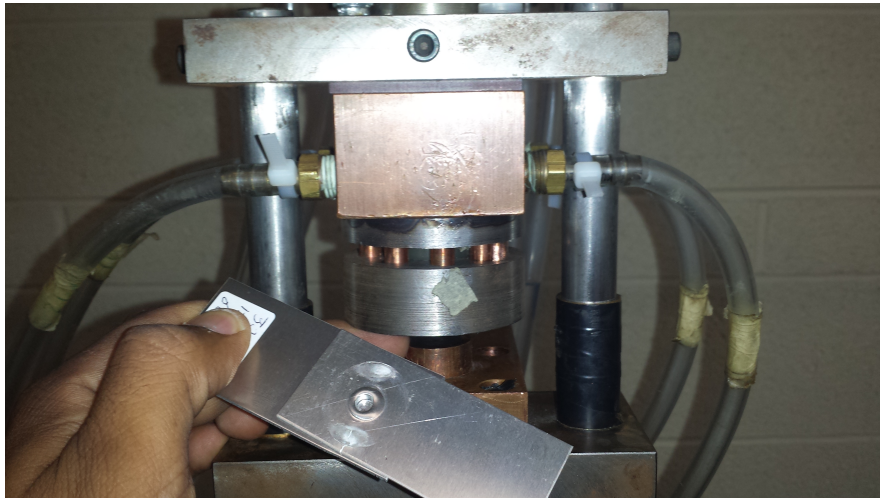


Figure 11: Pulling down the flat anvil

16. Turn off the hydraulics and shutdown the machine.

Contingency Plan and Reporting

Accident / injury response:

1. Apply first aid as required.
2. Notify Mechanical Engineering technical staff immediately.
3. For all injuries, complete a 'Injury/incident report' and provide a copy to the Chair and EOHSS.

In the Case of Serious/Critical Injuries

1. In case of critical injury, call security (dial 88) and notify EOHSS immediately, Ext 24352.

Equipment Malfunction and Hazards

1. Press STOP (red) button on the control box immediately and turn off the main power supply.
2. Hydraulic line may have leak or breakage.

3. Slip hazard from oil leak (use spill kit).

Equipment shutdowns

1. Contact technical staff in JHE 205, Ext 24628.

“Do NOT Do List for Users”

1. Do not apply load to a test specimen on the Servo-hydraulic mechanical test system without setting the load limits on it.
2. Do not touch the test specimen while the test is in progress.
3. Do not hold the hot test specimen with your bare hands immediately after the test.
4. Do not forget to report any abnormalities in the machine function to Dr. Jain immediately.
5. Do not forget to report any oil leakage from the servo-hydraulic press to Dr. Jain immediately.

Environmental Responsibility**Waste disposal procedures**

No waste is produced during normal operation. In case of oil leak, use absorbant material (spill kit) and dispose of the contaminated waste through EOHSS hazard waste collection.

Building air quality

All exhaust fumes exit the building via roof vent. If any smells are noticed while the machine is on, notify the technical staff in JHE 205, Ext 24628.

References

1. OHSA/ regulations
2. EPA and Municipal environmental regulations
3. RMM #100 McMaster University Environmental Health and Safety Policy
4. Material Safety Data Sheets (MSDS)
5. RMM #300 Safety Orientation and Training Program
6. RMM #301 Standard Operating Procedures

Distribution

1. Supervisor
2. Researchers who are working on the machine
3. Technical staff of Mechanical Engineering
4. Faculty of Engineering JHSC (for review)

Legal Disclaimer

The Standard Operating Procedures on this website are provided for the use of the McMaster University employee and/or student community. The procedures outlined in the above referenced document are intended to reflect best practices in this field; as such they are provided to the community for guidance and/or direction. However, these recommendations should not be construed as legal advice.

Risk Management Manual (RMM)
<http://www.workingatmcmaster.ca/rmm/>

Environmental and Occupational Health Support Services
<http://www.workingatmcmaster.ca/eohss/index.php>