

# MME Standard Operating Procedure (SOP)

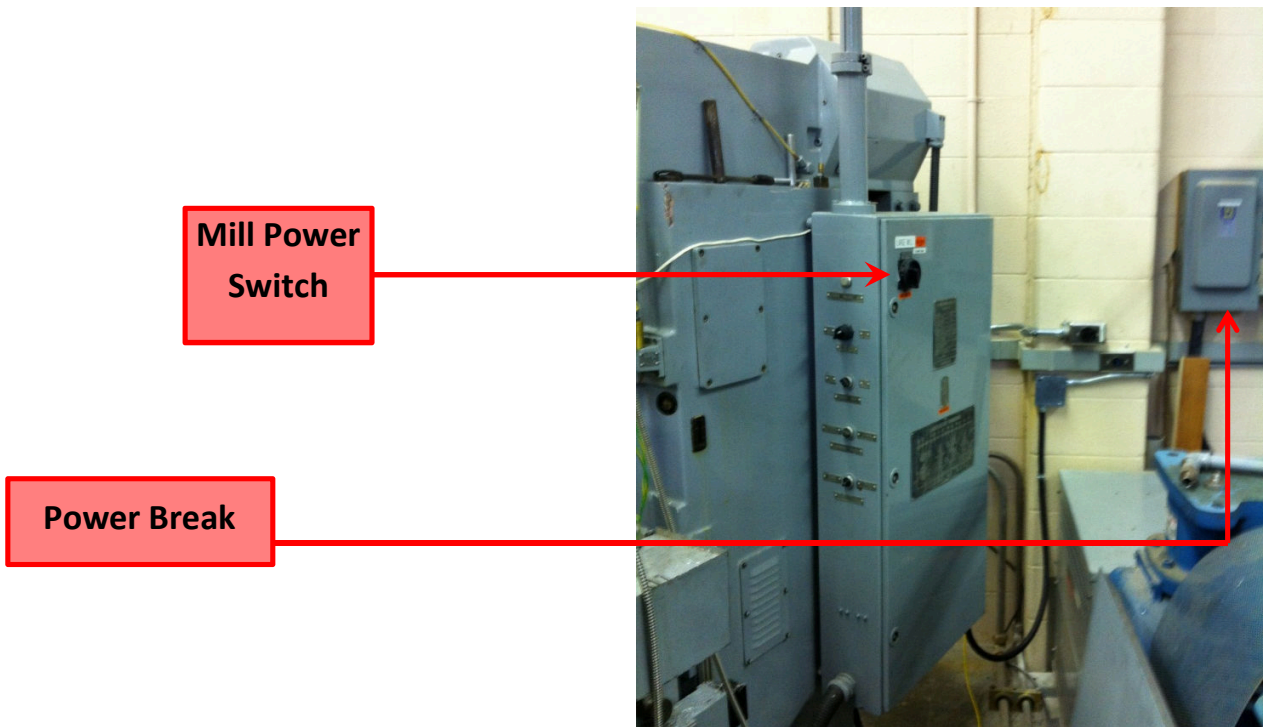
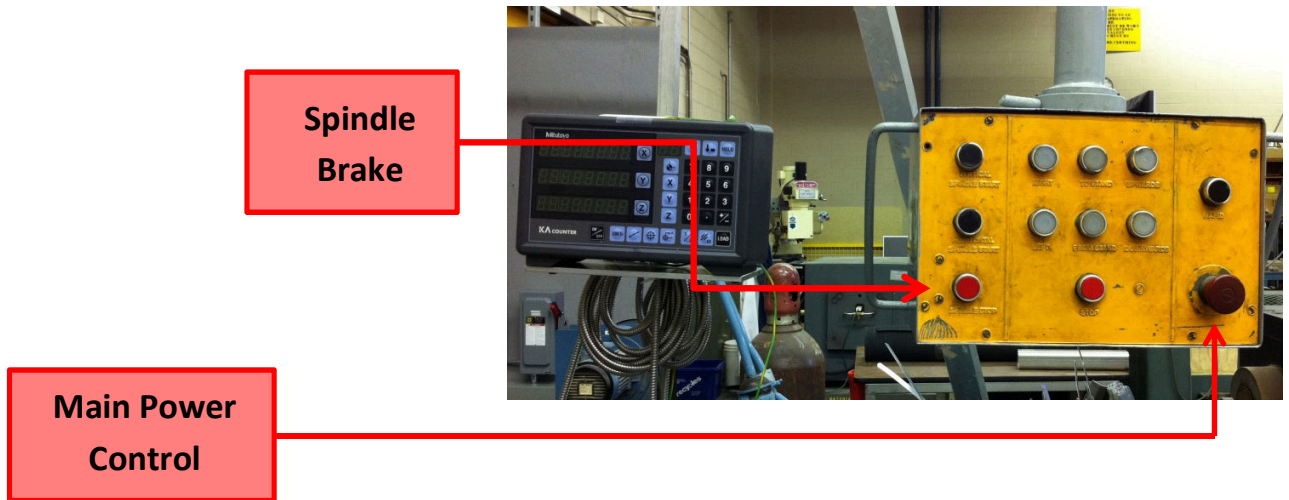
<b>Name</b>	<ul style="list-style-type: none"> <li>Friction Stir Processing using the Jafo Milling Machine (Model FWR40J)</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Standard 3-axis milling machine (utilizes a rotating cutting tool to shape metal pieces along three axis of movement). In this particular application, two metal bodies are joined by the process of stir friction processing.</li> </ul>
<b>Location</b>	<ul style="list-style-type: none"> <li>E3 2137</li> </ul>
<b>SOP Creation Date</b>	<ul style="list-style-type: none"> <li>2013-05-23</li> </ul>
<b>SOP Created By</b>	<ul style="list-style-type: none"> <li>Adrian Gerlich</li> </ul>
<b>SOP Revision Date</b>	
<b>SOP Revised By</b>	
<b>SOP Location</b>	<a href="https://sharepoint.uwaterloo.ca/sites/MME/Inventory">https://sharepoint.uwaterloo.ca/sites/MME/Inventory</a>
<b>Manual Location</b>	<ul style="list-style-type: none"> <li>-----</li> </ul>
<b>Equipment Owner</b>	<ul style="list-style-type: none"> <li>Richard Gordon/ MME</li> </ul>
<b>Authorized Trainers</b>	<ul style="list-style-type: none"> <li>Adrian Gerlich</li> </ul>
<b>Support Technicians</b>	<ul style="list-style-type: none"> <li>Richard Gordon</li> </ul>

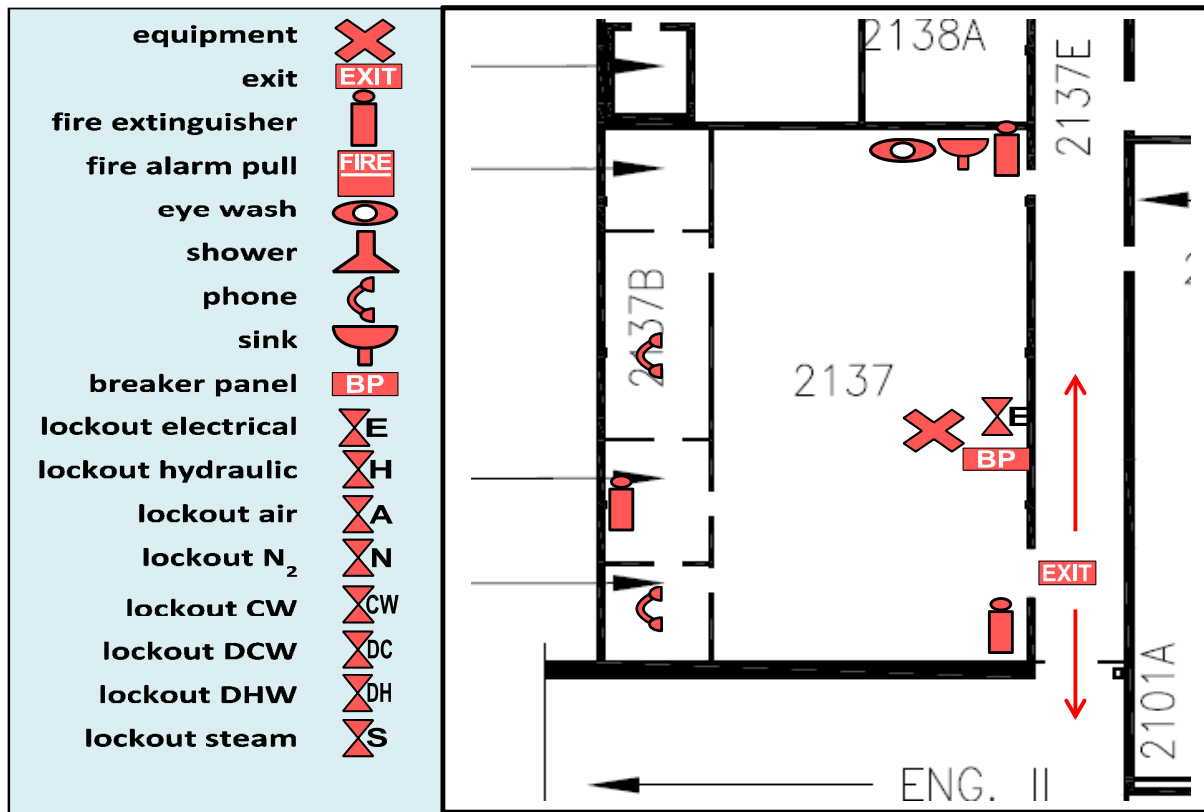


<b>Significant Hazards</b>	<ul style="list-style-type: none"> <li>Rotating tool piece can cause physical injury when in operation</li> <li>The work piece being worked on can pose physical danger if not properly secured during operation of the milling machine</li> <li>Hot chips from machining can cause burns</li> <li>Movement of the milling bed can cause pinch points</li> </ul>
<b>Administrative Controls</b>	<ul style="list-style-type: none"> <li>This piece of equipment can only be used under the supervision, express permission, or directly by a listed technician during standard operating hours</li> <li>All long hair must be tied back. Any loose jewelry around the wrist or wristbands must be taken off when operating the machine</li> <li>Keep hands clear of the cutting tool when it is in operation</li> <li>Ensure that the machine is off when it is not in use or when the cutting tool is being changed</li> <li>Always clean the work area of metal shavings and chips with a brush – never clean the area with bare hands</li> <li>Properly secure any work piece using the vise positioned on the bed of the milling machine</li> </ul>
<b>Engineering Controls</b>	<ul style="list-style-type: none"> <li>None</li> </ul>
<b>PPE Required</b>	<ul style="list-style-type: none"> <li>Safety glasses</li> </ul>
<b>Relevant Standards and Codes</b>	<ul style="list-style-type: none"> <li>None</li> </ul>
<b>Relevant MSDS</b>	<ul style="list-style-type: none"> <li>Waylube 68 (Produced by Monarch Ltd.)</li> <li>Hydraulic Oil 32 AW R&amp;O (Produced by Monarch Oil Ltd.)</li> </ul>

<b>Accident Procedure</b>	<ul style="list-style-type: none"> <li>• In the case of a gash or laceration (as severe as a complete sever), elevate, wrap, and apply pressure to the wound.</li> <li>• In the case of an injury caused by a pinch point, apply a cold compress. If blood has been drawn, wrap and apply light pressure to the wound</li> <li>• In the case of a minor burn, apply a cool compress</li> </ul>
<b>Emergency Shutdown Procedure</b>	<ul style="list-style-type: none"> <li>• Hit the brake located on the console to the right of the machine</li> <li>• Turn off the machine</li> <li>• Switch off the breaker located on the wall behind the mill</li> </ul>

Labelled Pictures of Specified Machine and Important Safety Features





### Pre-start Checklist

- Clean off any metal shavings or chips from work area
- Have coolant on hand for use during machining if needed
- Check that there is adequate space around the mill for the desired operation
- Check that the cutting tool is undamaged and properly secured in the spindle
- Check the lubrication gauges and make sure the machine has enough lubrication
- Ensure the rotation speed and feed rate are appropriate for the tool size and work-piece material
- Ensure the work piece is properly secured by the vise
- Confirm the breaker located on the wall behind the milling machine is on

### Start-up Procedure

- Chip Safety Covers should be inserted before operating the machine
- Set the milling machine to the desired cutting speed

### Operating Procedure

- Turn on the mains switch located at the right side panel on the machine
- The table movements won't work independently from the spindle movement, unless the Rapid traverse button is pressed. Thus the spindle needs to be running in order to operate the table movements.
- The switches on the control panel can be used to move the table in all the axial directions but no two movements can be done simultaneously
- Table movement speed:  
Upper position, A : Slow  
Lower position, B : Fast
- Loosen the metal holders on the table and firmly position sample underneath the holders
- Lower the table and move it so that the rotating tool is to the left end of specimen. Note that the shoulder of the tool must not be directly above the specimen.
- Adjust the table height so that the pin should theoretically penetrate but not fully puncture through the specimen
- If the specimens to be welded are of equal width, take note of the ridged bar located on the left side of the machine. Adjust the nut so that the first protruding button is pushed in. This will set the limit to which the table will rise and thus the penetration depth of the pin.
- Move the table down and position the pin a couple centimetres from the left end of the sample
- Turn on the machine and begin rotation using the green and black button on the control panel
- Raise the table allowing pin penetration and move table to the right
- Weld sample until about an inch from the right end and stop process
- Apply coolant as required

### Shutdown Procedure

- Once the sample has been welded about an inch from right side stop the process with the help of main control panel
- Lower table and allow sample to cool. Remove samples by loosening the hold-down screws
- Always check that the milling machine is turned off after use
- Remove and return the cutting tool that was used
- Switch off the aforementioned circuit breaker on the wall behind the machine

**Clean-up**

- Clean up any metal shavings on and around the work area with a brush
- There are no logs for cleaning this machine

**Lockout**

Follow the standard shutdown procedure listed above, ensuring the breaker is switched off.

**Maintenance and Repair**

No maintenance logs or schedules exist for this piece of equipment. Apply spindle oil to the machine as needed and monitor the hydraulic oil and Waylube. Refer to the machine manual as a reference for any additional maintenance or repair operations, as well as to find information on replacement parts. This milling machine is a product of Jafo (Jarocińska Fabryka Obrabiarek). Parts and service are available through Zetkam Consulting & Machinery, (416) 576-4933, [zetkam.com/contact.htm](http://zetkam.com/contact.htm)