DEPARTMENT OF MECHANICAL ENGINEERING

Name of SOP	Mill usage room 207
Effective Date	Nov 2007
Author	Jim McLaren
Reason for SOP	Check All that Apply: [x] Procedure/Process could cause critical injury. [ ] Procedure/Process could cause occupational illness. [ ] Procedure/Process could cause environmental impairment. [x] Procedure/Process could damage University property. [ ] Supervisor's discretion. Provide Details: Potential for injury due to rotating machinery Injury from metal cuttings or objects/work piece ejected from machine.
Approved by (supervisor)	Ron Lodewyks
Date reviewed by JHSC	

Definitions

Terms	none
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.

1. OHSA code.
1. McMaster University Risk Management Policies

Training and competency.

1. Training provided by Mechanical Engineering technicians .
2. Lab supervised by Mechanical Engineering technicians
3. Competency is shown by the individual after training. Those persons using the facilities must attend a "shop safety course" and pass a written test in order to use the shop facilities

Description of the Task

Location and time of work	JHE 207, 207A, 207B, 207C during normal working hours
Individuals and skills required	Undergraduate students, graduate students, faculty members, workers etc. who have attended the mandatory "Machine shop safety" training course. Those who have demonstrated competency or

	have received instruction in the required process procedure.
Equipment and supplies required	Vertical milling machines, standard and special work holding devices as required eg. Vises ,vee blocks, angle plates ,cutter holding collets dividing head etc. Standard and special cutting tools and their holders , cutting inserts, drills, reamers etc
Personal protective equipment required	Safety glasses, As required hearing protection or foot protection

Sequential Steps to Complete the Work Safely

General safety instructions

1) **Develop and use common sense** when using the equipment (think before you act).
2) Be sure to discuss the operation of the mill in detail with the Technician before operating the machine
3) Do not operate the machine until you have had proper training.
4) Make sure the work piece is adequately clamped for the job being performed. The clamping force must be high enough to resist movement under these conditions. Make sure the Technician checks the part clamping before starting the machine
5) Make sure the tool holder and cutting insert are adequately clamped for the job being performed.
6) **Always wear safety glasses** when around the machine.
7) Long hair should be tied back to avoid being caught in the revolving parts of the machine **(Keep loose items away from rotating objects)**.
8) Loose clothing, rings or watches must not be worn when operating machine tools to avoid being getting caught in the rotating part of the machine.
9) Wear long pants (preferably cotton) as metal cuttings removed from the work piece during the machining process can reach temperatures in excess of 300ºC and will burn.
10) **No sandals or open toed shoes are permitted in the lab.**
11) Watch out for sharp edges on the part, tool and on the chips.
12) Do not use rags near the rotating machines when the spindle is running. Rags can be caught in the rotating spindle and the result can be serious injury. Rags may be used for material handling and for cleaning purposes provided there are no rotating hazards nearby.
13) Use extreme caution with the chips produced during machining. Chips are sharp and some chips are long stringers which can easily be caught up in the spindle and thrown with great force. Do not clear chips away from the work area when the machine is in operation. If it is necessary ask the Technician how this can be best done.
14) It is mandatory to report all cases of injury to the Technician
15) Anyone using the lab equipment is expected to work safely at all times. If you do not work safely you will be asked to leave.. Re-admittance to complete the lab requires the approval of the department chair. You are responsible for your safety and the safety of others working around you. If you do not know how to safely operate the equipment it is your responsibility to obtain the proper instruction from the Technician

Sequential steps to complete the work safely.

1) Safety glasses must be worn
2) If competency level has been achieved continue setting up machine. If not revue safety rules with Mech. Eng. Technician. If competency level has been achieved continue setting up machine
3) Make sure the work piece is properly secured before turning on the power
4) For additional information on specific machine tool operations see the text book “Technology of Machine Tools” kept in the Technician’s office.

Power-Up sequence

1) Unlock wall breaker box and throw switch to on position
2) Make sure emergency stop button is released Pull stop toward you . (Fig. 1)

Machine operation

1. Secure the work piece using the appropriate fixture, clamp or vise
2. Mount the appropriate tool in spindle and tighten . (Fig. 2)
3. Select proper RPM (Fig. 3)
4. Select proper feed rate (Fig. 4)
5. Position tool using cross feed and table traverse hand wheels in manual or powered mode as appropriate (Fig5)
6. Set depth of cut using vertical hand wheel in most cases the spindle should be running when the cutter is introduced to the work piece in order to avoid chipping the tool (Fig 5)
7. Start spindle (Fig 1)
8. Engage feed (Fig. 4)
9. After cut has finished STOP FEED .(Fig 4)
10. Stop spindle (Fig 1)
11. If the process is one that the operator is unsure of, or lacks experience with any of the above sequences consult with a technician. The reference textbook "Technology of Machine Tools" (sixth edition) kept in room 205 is useful in explaining some of the different operations that can be performed on the Milling Machine.

Power down sequence

1. Press red emergency stop button.
2. Switch off breaker
3. Clean and remove all cuttings from machine
4. Use gloves if necessary
5. Clean floor area around machine

Contingency Plan and Reporting

Accident / injury response

1. Notify Mechanical Engineering technical staff .Apply first aid as required immediately .
2. For all injuries complete a "Injury/Incident Report" and provide a copy to the Chair and EOHSS
3. In case of critical injury call security (DIAL 88).
4. In case of critical injury notify EOHSS immediately, ext 24352

Spill response

If **coolant** is spilled contact a technician who will determine which of the following is appropriate.
In small quantities use available absorbent to minimize slipping hazard.
In larger quantities use a wet/dry vacuum to remove coolant from floor replace into the machine if suitable. If coolant is not useable due to contamination the technician will package and follow established hazardous waste practices for disposal.

If **oil** is spilled contact a technician who will determine which of the following is appropriate.
In small quantities use available absorbent to minimize slipping hazard.
In larger quantities use a wet/dry vacuum to remove oil from floor, the technician will package and follow established hazardous waste practices for disposal.

Equipment shutdowns.

In cases where the machine malfunctions or seems to behave in an erratic manner eg. fails to start, stop or displays excessive vibration etc. contact a technician immediately.
When repairs are made the lock out tag out procedures of 306 Lockout / Tag-out Program will be followed.

Environmental Responsibility

Waste disposal procedures

As indicated in the "Spill Response" area above when oil or coolant is spilled or replaced for maintenance purposes these activities are to be performed or directed by the technical staff who will follow 502 Hazardous Waste Management Program

Building air quality

In some operations cutting oils will generate smoke in these cases use the local exhaust fans to clear the air.

References (OHSA/ regulations, EPA and Municipal environmental regulations, McMaster University Program/ Policy, Material Data Sheets (MSDS).

1. RMM Policy #300 Safety Orientation and Training Program
2. RMM Policy #301 Standard Operating Procedure
3. RMM 306 Lockout / Tag-out Program
4. RMM Policy #309 Laboratory Safety Manual
5. RMM Policy #310 Eye Protection.
6. RMM 317 Machine Shop Safety Program
7. RMM Policy #403 Noise Control and Hearing Preservation
8. RMM Policy #1000 Reporting and Investigating Injury, Incidents and Occupational Disease

Distribution

1. Supervisor
2. Technical Staff of Mechanical Engineering
3. Available in JHE 207 for reference
4. Faculty of Engineering JHSC

Risk Management Manual (RMM)
http://www.workingatmcmaster.ca/link.php?link=Job+Matters%3APolicy-Manual

Environmental and Occupational Health Support Services
http://www.workingatmcmaster.ca/link.php?link=Job%20Matters:EOHSS

Fig.1


Spindle stop
Spindle start
Vertical rapid feed
Power on Light
E-Stop
Jog Motor
0
I
1
MILLING MACHINE #1
6888

Fig.2

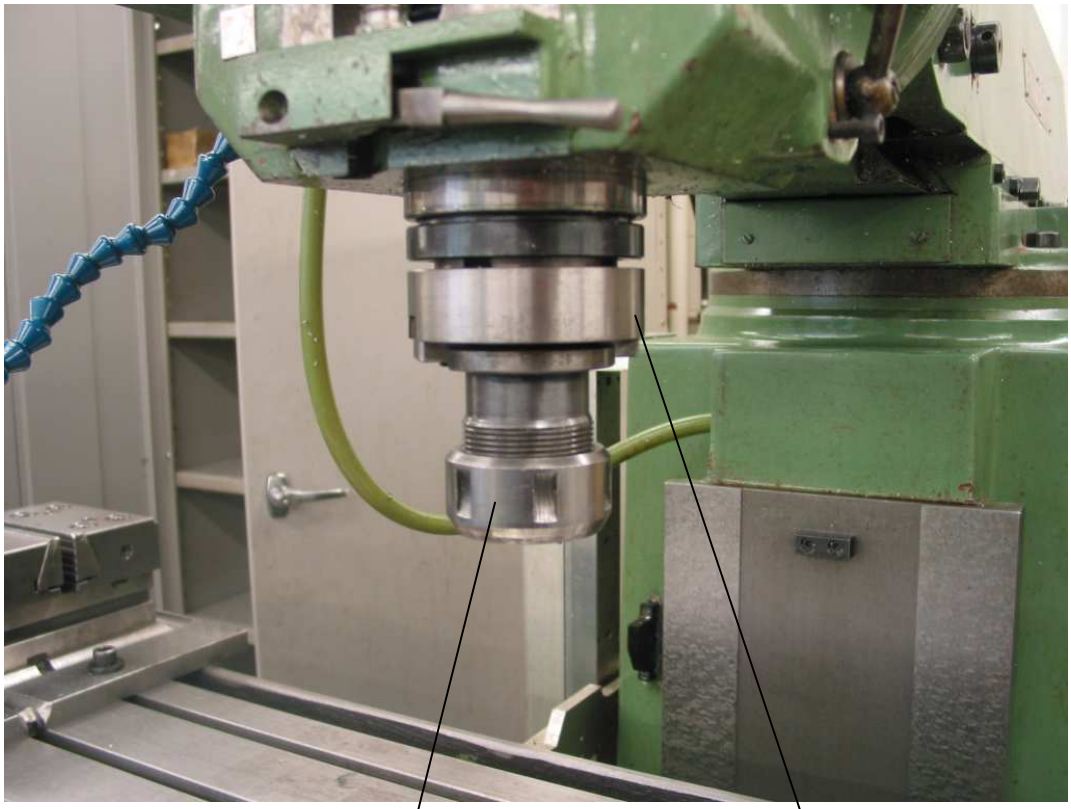
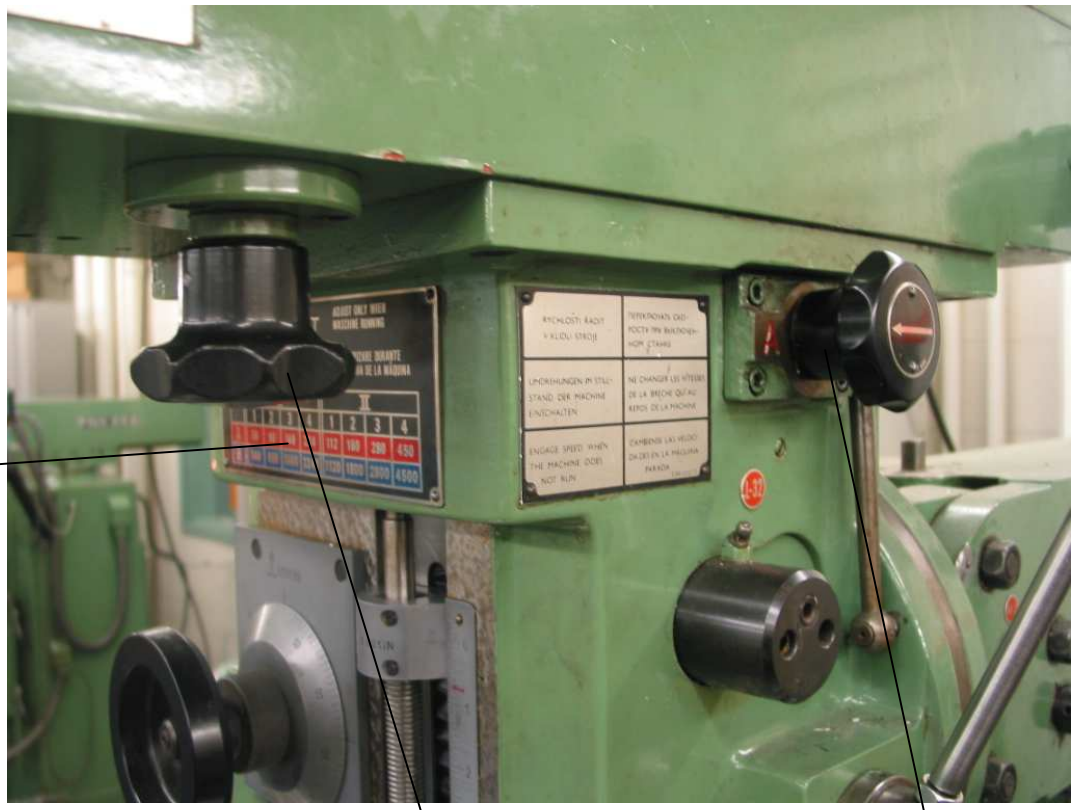


Fig.3



Spindle speed Chart

Variable speed Spindle control (ONLY ADJUST WITH SPINDLE RUNNING)

Gear change control knob
(Only adjust with spindle STOPPED)

Fig.4

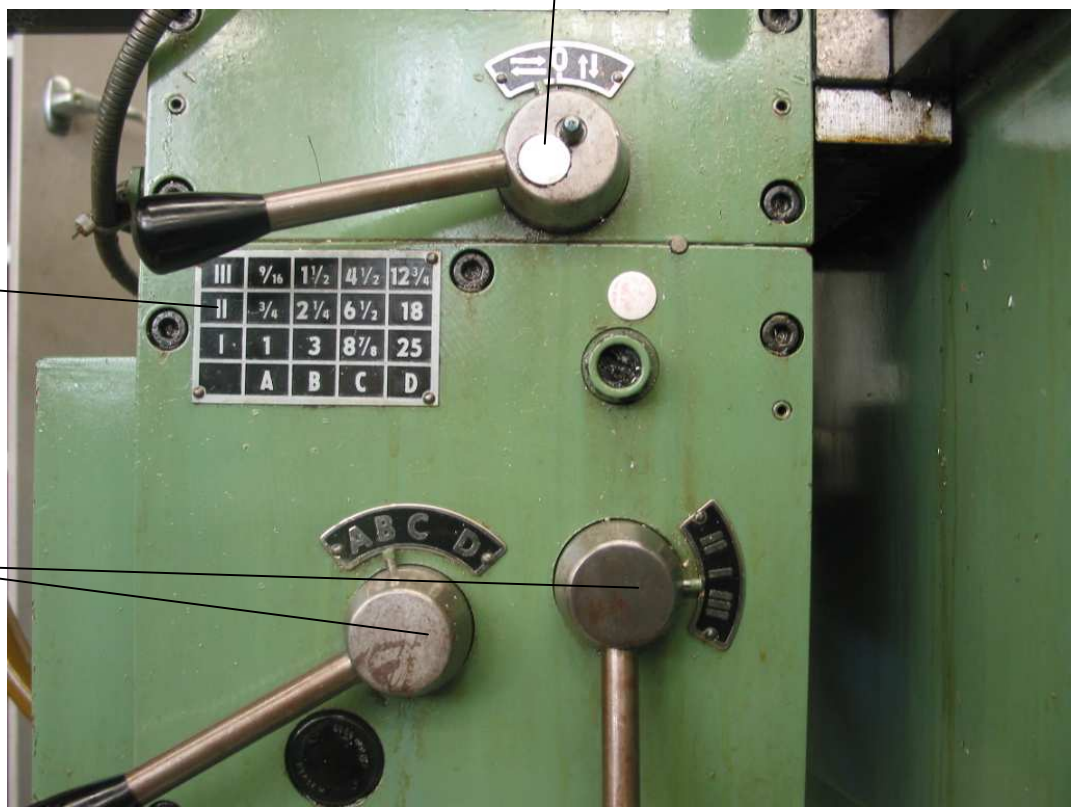

Directional axes
Lever (X or Y)
Feed
Chart
Feed
selection
levers
III 9/16 1 1/2 4 1/2 12 3/4
II 3/4 2 1/4 6 1/2 18
I 1 3 8 7/8 25
A B C D
A B C D

Fig. 5


X axis hand feed handle
Y axis hand feed handle
Z axis hand feed handle

Fig 6

Automatic feed
Engaging lever