# DEPARTMENT OF MECHANICAL ENGINEERING

| **Name of SOP** | F11 Water Hammer |
|---|---|
| Effective Date | March 30, 2004 Rev. January 21, 2008 |
| Author | M.F. Lightstone |
| Reason for SOP | Risk of personal injury |
| Approved by (supervisor) | Ron Lodewyks |
| Date approved by (JHSC) | February 13, 2008 |

**Definitions**

| Terms | |
|---|---|
| Acronyms | RMM – Risk Management Manual<br>JHSC - Joint Health and Safety Committee<br>Chair - Chair of Mechanical Engineering<br>EOHSS - Environmental Occupational Health & Safety Service |

**Requirements**

**Applicable OHSA regulations and / or codes of practice.**

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

**Training and competency.**

1. Training provided by technical staff in the Mechanical Engineering Department.
2. Competency is shown by the individual after training

**Description of the Task**

| | |
|---|---|
| **Location and time of work** | JHE-314 during normal working hours |
| **Individuals and skills required** | Graduate Students, none |
| **Equipment and supplies required** | Pressurized water/air tank, compressed air tank, copper pipe, solenoid valve, valve, Rota meter, analog pressure gauge, pressure transducer, oscilloscope |
| **Personal protective equipment required** | None |

**Sequential steps to complete the work safely.**

**General safety instructions:**

1. Do not overreach
2. Keep proper footing and balance at all times
3. Do not lean on the equipment. Movement of the wheeled stands may result in equipment falling and injury to the experimentalist
4. Do not touch the acrylic shield of the glass tube attached to the compressed air tank
5. Ensure that water from the apparatus drains properly into the floor drain. A wet floor can result in slippery conditions.
6. Guard against electric shock.
7. Keep work area clean. Cluttered areas and benches invite injuries.

**Specific instructions for operation of the equipment:**

**TEST SET 1: (Constant tank pressure, varying flow rates)**

1. Open the valve connecting the compressed air tank to the compressed air line to obtain the desired pressure in the system. The pressure is measured using the analog pressure gauge mounted on top of the tank. Close the valve once the desired pressure is reached.
2. Adjust the flow rate through the copper pipes by opening the second valve. Ensure that water from the apparatus drains properly into the floor drain. The flow rate is measured using the Rota meter near the exit of the piping system.
3. Reset the oscilloscope.

4. Close the solenoid valve using the switch mounted on the front of the table and manually trigger the oscilloscope. The pressure transient can be determined from the oscilloscope trace.
5. Repeat for a range of flow rates.
6. Repeat steps 1 through 5 for two or three larger pressures.

**TEST SET 2: (Constant flow rate, varying tank pressures)**

1. Set the pressure in the system to the desired value by opening the valve connecting the compressed air tank to the compressed air line.
2. Set the flowrate through the copper pipe to a moderate value (for example, 6 litres/min) by opening the second valve.
3. Initiate the water hammer by closing the solenoid valve and determine the pressure transient as indicated in step 4 of Test Set 1.
4. Repeat steps 1 through 3 for a range of system pressures.

**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
4. In case of critical injury call security (dail 88).
5. In case of critical injury notify EOHSS immediately, ext 24352

**Spill response**

.Spillage of the water could result in slippery conditions. In the event of a spill, notify the graduate student in charge of the experiment or the technical staff in JHE205, ext. 24628. Guard against electric shock.

**Equipment shutdowns.**

1. Turn off the water supply to the tank and ensure compressed air is turned off.
2. Turn off the oscilloscope and pressure transducer power supply.
3. Open slightly the air pressure release valve at the top of the tank and allow air to escape slowly.

**Environmental Responsibility**

**Waste disposal procedures**

Procedure does not generate waste.

**Building air quality**

Procedure does not affect air quality

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

1. RMM #301 Standard Operating Procedure
2. RMM #300 Safety Orientation and Training Program
3. RMM #309 Laboratory safety manual

RMM #1000 Reporting and Investigating Injury, Incidents and Occupational Disease

**Distribution**

1. Trained teaching assistant who is the lab operator
2. Technical Staff of Mechanical Engineering
3. Mechanical Engineering Chair
4. Faculty of Engineering JHSC