Metal Forming Laboratory (Mechanical Eng'g Dept.)
STANDARD OPERATING PROCEDURE (SOP)

Name of SOP	Kawasaki JS-6 Robot Arm
Effective Date	May 16, 2007
Author	Tim Nye
Reason for SOP	Risk of injury while operating Kawasaki Robot
Approved by (supervisor)	
Date approved by JHSC	

Definitions

Terms	none
acronyms	RMM – Risk Management Manual JHSC - Joint Health and Safety Committee EOHSS - Environmental Occupational Health & Safety Service PDU – Plasma Display Unit

Requirements

Applicable OHSA regulations and / or codes of practice.

1. OHSA code.
2. CAN/CSA Z434-03 Industrial Robots and Robot Systems – General Safety Requirements
3. ANSI/RIA R15.06-1999 Standard for Industrial Robots and Robot Systems - Safety Requirements
4. McMaster University Risk Management Policies

Training and competency.

1. Technical Staff in the Mechanical Engineering Department.
2. Competency to be demonstrated by the individual after training.

Description of the Task

Location and time of work	JHE 108 during normal working hours
Individuals and skills required	Graduate Students with adequate training as defined above.
Equipment and supplies required	Kawasaki Robot Arm controlled by either the control unit PDU, the teach pendent or a computer with the robot behind physical barriers
Personal protective equipment required	Safety Glasses

Sequential steps to complete the work safely.

General safety instructions

1. All users must obey the safety instructions listed in the Kawasaki "A/AD Controller Operations & Programming" reference manual.
2. The operator must only access the robot arm's working space when the robot controller is turned off or an emergency stop (E-stop) button has been pressed so that motor power is off.
3. When operating the robot arm always have an emergency stop button close at hand in case the robot needs to be immediately stopped. This can be the emergency stop button on the teach pendent or the emergency stop button on the front of the control unit PDU.
4. Never place yourself in a location that confines you between the robot arm and another object.
5. Never operate the robot at speeds exceeding 250 mm/sec.

Interim Specific instructions:

1. Robot work area interim barriers are the benches and machinery surrounding the robot. When robot motor power is on, do not enter this area.
2. Robot is only to be used during normal University business hours, 8:30 to 4:30 on weekdays.
3. Before entering the robot workspace, make sure either the controller is powered down, or an E-stop

button is pressed so that motor power is off.

Specific instructions for the operation of the Kawasaki robot arm:

Power On Procedure:

1. Ensure that all personnel are clear of the work cell and all safety devices are in place and operational.

2. Place the 2-position HOLD/RUN switch in the HOLD position.

3. Turn the main disconnect to the ON position. At this time the CONTROL POWER indicator lamp will illuminate.

4. To select Teach Mode and apply motor power, use the following steps:

   a. Place the 2-position TEACH/REPEAT switch on the Operator Interface Panel or the Separation Operation Panel in the TEACH position.

   b. Place the TEACH ON/OFF selector switch on the Optional Interface Panel in the ON position, if so equipped.

   c. Remove the Teach Pendant from its holder and check the Teach Pendant LCD display for any error conditions.

   d. Check the robot controller for any error conditions.

   e. Select the teach mode on the Teach Pendant by pressing TEACH LOCK ON on the pendant.

   f. Place the 2-position HOLD/RUN switch in the RUN position. The MOTOR POWER INDICATOR at this time will not illuminate because the Deadman Grips (switches) are not depressed, and the MOTOR POWER pushbutton has not been pressed.

   g. Press one of the Deadman Grips, and press the MOTOR POWER pushbutton. At this time the MOTOR POWER indicator lamp will illuminate.

5. To select Repeat Mode and cycle start a program, use the following steps:

   a. Place the 2-position TEACH/REPEAT switch on the Operator Interface Panel or the Separation Operation Panel in the REPEAT position.

   b. Place the TEACH ON/OFF selector switch on the Optional Interface Panel in the OFF position, if so equipped.

   c. Ensure teach mode on the Teach Pendant is OFF by pressing TEACH LOCK switch to the OFF position on the pendant.

d. Press the PRG SEL key on the function menu keypad and select the desired program to execute in repeat mode.

   Verify that the program selected is the correct program to begin operation. In many applications this program is called the mainline program and is labeled "pg00".

e. Place the 2-position HOLD/RUN switch in the RUN position.

f. Press the MOTOR POWER pushbutton to apply motor power. At this time the MOTOR POWER indicator lamp will illuminate.

g. Check the robot controller for any error conditions.

h. Press the CYCLE START pushbutton to begin executing the selected program. At this time the CYCLE START indicator lamp will illuminate.

It is important to realize that when CYCLE START is pressed, the robot will take the shortest path from where it is to where it is directed to go. In other words, it moves from its present location to the next location with total disregard for anything that may be in its path.

Power Off Procedure:

1. Ensure that all personnel are clear of the work cell and all safety devices are in place and operational.

   NOTE: Procedure Number 2 below is only applicable to A/AD Controllers that are equipped with a keyboard. If a keyboard is unavailable, skip to Procedure Number 3.

2. If the fixturing and workpiece are not present, or if sending the robot to the home position can be executed without interference with anything that exists in the work envelope, send the robot to the HOME position. To send the robot to the HOME position, perform the following procedure:

   - Turn the TEACH/REPEAT switch on the Function Panel to REPEAT and turn the TEACH LOCK switch on the teach pendant to OFF.
   - Ensure that motor power is on.
   - Access the monitor prompt (>▌ sign followed by a blinking prompt) in the lower left corner of the PDU. If not displayed, exit out of any menus until "user display" is displayed in the lower right corner of the PDU. Press "F6" (user display) on the Function Menu Keypad or press the "CNTRL" and "Z" keys simultaneously. Completion of this procedure allows the user to type in AS language commands.
   - Access the Keyboard, type "DO HOME" and press the "RETURN" key. The robot will then move to the "HOME" position.

3. Ensure that robot motion has stopped and the motor power is disabled prior to the next step of this procedure.

4. Turn the main disconnect to the OFF position. At this time the CONTROL POWER indicator lamp will turn off.

Robot Operation Procedure:

The robot may be operated interactively from the Teach Pendant, Controller Terminal, or through running of programs stored in the Controller. Refer to the ***A/AD Controller Operations & Programming Reference manual.*** for details of these operations.

Contingency Plan and Reporting

Accident / injury response
Report all minor cuts and bruises to the Technical Staff in room JHE 205, ext. 24628.

In the Case of Critical Injuries

1. Shutdown equipment and secure the area to prevent further injury.
2. Immediately arrange for medical and emergency assistance by calling Security at Ext. "88".
3. Apply first aid as required.
4. Notify EOHSS immediately. Ext 24352.
5. Notify Technical Staff immediately. Ext 24628.

For all injuries complete a "Injury/Incident Report" and provide a copy to the Chair and EOHSS.

Equipment Malfunction
In the event of an equipment malfunction, (unexpected motion, non-resetable robot errors, abnormal sounds, etc.) shut the robot off using the disconnect switch on the side of the controller and immediately contact the Technical Staff in room JHE 205.

Equipment shutdowns

1. **To stop the robot in an emergency**, push one of the emergency stop buttons located on the teach pendent, the front of the control unit PDU.
2. **For a controlled shut down of the robot**, allow the program to finish normally, send the robot to the home position and shut off the power using the disconnect switch on the side of the controller.
3. **For a maintenance shut down of the robot,** turn off the main power disconnect switch and apply a lock and identification tag to the switch before accessing the robot control unit. The disconnect switch is located on the West wall of the lab just south of the robot controller.

Environmental Responsibility

Waste disposal procedures
Procedure does not require disposal

Building air quality
Procedure does not effect air quality

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

1. RMM #300 Safety Orientation and Training Program
2. RMM #301 Standard Operating Procedure
3. RMM #309 Laboratory safety manual
4. RMM #310 Eye Protection Program

Distribution

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2. Dr. T. Nye JHE 102 ext. 27752
3. Technical Staff of Mechanical Engineering JHE 205 ext. 24628