Grand Rapids Community College

Course Cover Sheet

M-CAM Training Area:
☐CNC/Machining ☐Multi-Skilled/Mechatronics ☐Production Operation ☒Welding/Fabrications

Program(s): Welding Technology

Course: MN 233-Welding Automation

Course Description: 3 credit, 4 contact hour course

Date Created: 2013

Faculty Developer(s)/Instructional Designers(s): John Doneth

Employer/Industry Partner: American Welding Society, Lincoln Electric, Steelcase, Shape Corp, Praxair

College Contact: David Lovell

Phone: 616-234-3168

Email: davidlovell@grcc.edu

Additional Information/Comments: The one-year Welding Technology Certificate Program at GRCC was adjusted through M-CAM to align with the AWS SENSE level 1 industry-recognized credential per feedback from GRCC's welding advisory committee members, who communicated that the AWS certificate was the industry standard. Employers contributing to this change were Steelcase, Shape Corp, Praxair, and others.

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warrantees, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

Catalog Search

Search Catalog

Advanced Search

- Catalog Home
- Academic Programs
- Course Codes and Descriptions
- Catalogs (2011-2015)
- President's Welcome
- GRCC Academic Departments & General Office Contact Information
- Accreditations and Memberships
- History of GRCC
- Academic and Student Affairs Vision
- Academic Information
- Michigan Transfer Agreement (MTA)
- Academic Policies and Procedures
- Campus Resources
- Extended Learning Opportunities
- Higher Education Overview
- Continuing Education / Workforce Training
- Job Training
- Independent Study & Project Seminars
- GRCC Employees
- GRCC Campus Map
- My Catalog

[ARCHIVED CATALOG]

MN 233 - Welding Automation

(3/4)

Prerequisites: EG 110 & MN 230 completed with a C- or better. The introduction to welding automation will expose students to core concepts and theory behind automation practices as they are used in the industry. The class is a lecture and lab combination where the students will learn basic robotic programming for welding along with the use of other automation equipment. Special emphasis will be placed on welding joint design, setup, and the effects of welding parameters and their outcomes on welded members. The students will work in small groups to solve problems as a team and complete various lab assignments.

Recommended: Good basic math skills and college level reading and writing skills are recommended for this course.

(616) 234-4722

143 Bostwick Avenue NE
Grand Rapids MI 49503-3295

MN 233 WELDING AUTOMATION

Course overview (Note this is subject to change based on tours)

Group Presentation Names

1. Introduction
2. Safety Robot Programming
3. Robot Programming
4. Welding tooling / Weld Fixtures*
5. Robotic cell layout*
6. End of Arm Tooling (EOA)* _____
7. Positioners*
8. Automation Cycle Time Analysis* _____
9. Plant Tour
10. Automation setup
11. Lasers*
12. Quality*
13. Advanced Robotic Features _____
14. Work In shop
15. Final Exam

MN 233 Welding Automation Syllabus

General Information

Instructor Name

Contact Information and Availability

Preferred method of contact:
Office Location:
Office Hours:
Phone:
E-mail Address:

Course Information

MN 233 Welding Automation

The introduction to welding automation will expose students to core concepts and theory behind automation practices as they are used in the industry. The class is a lecture and lab combination where the students will learn basic robotic programming for welding along with the use of other automation equipment. Special emphasis will be placed on welding joint design, setup, and the effects of welding parameters and their outcomes on welded members. The students will work in small groups to solve problems as a team and complete various lab assignments. Good basic math skills and college level reading and writing skills are recommended for this course.

Student Learning Outcomes

1. Properly create and edit basic robotic welding programs.

2. Apply technical and theoretical knowledge from labs and lectures to solve related problems.

3. Create a welded assembly with the robotic welding system utilizing parts the students cut with the plasma system.

4. Cut parts utilizing the plasma arc cutting system using custom drawings and preloaded library drawings.

5. Properly manipulate welding variable to understand the effects each variable has on the process.

6. Create an original digital drawing (auto cad or other program) and post data to plasma arc cutting system.

7. Demonstrate teamwork by presenting a final group project.

8. Demonstrate proper setup of robotic tool center points.

9. Demonstrate proper robot calibration by Zero Mastering the robotic arm.

10. Write lab reports according to instructor guidelines.

11. Calculate cost savings using automation versus manual processes.

Required Materials

There is no textbook for this class, however materials will be provided through blackboard and students are expected to print the material as needed.

Course-Specific Requirements

There may be offsite visits to local companies. This will take place during normal classroom hours.
This course is a lecture and lab class. Students must supply their own personal work clothes and safety equipment, such as foot wear, safety glasses ect. These items must be adequate for shop work. Flip flops, sandals or any open shoes are not allowed in the lab. Any student not dressed for work will not be allowed to work in the welding lab. Shorts will not be allowed in the lab. A student must sign in on the daily class sign-in sheet to receive credit for attendance.

Section Policies

Attendance Policy

There is no extra time available to make up laboratory projects. Students must be here each week to ensure successful completion. Student's missing more than two classes will lose points in the laboratory and students missing three or may classes may receive a failing grade.

Grading Procedure

Robot Labs	200 points
CNC Plasma Lab	100 points
Sub Arc Lab	100 points
Presentation	100 points
Presentation paper	100 points
Sub Arc paper	100 points
Quizzes	100 points
Mid Term exam	100 points
Final exam	100 points
Total	1000 points

Grading Policy

Scale

A	100-95%	B	86-84%	C	75-72%	D- 61-59%
A-	94-90%	B-	83-80%	C-	71-69%	E 58
B+	89-87%	C+	79-76%	D+	68-66%	

Late Assignment Policy

Late assignments will only be accepted with one week of the due date. A ten percent reduction in grade will also be assessed upon the late assignment.

College Policies

GRCC Email and Course Communications

Students are responsible for all communications sent via Blackboard and to their GRCC

email account. GRCC student email can be accessed through Student Email (http://email.grcc.edu) and Blackboard at Blackboard (http://bb.grcc.edu). Grand Rapids Community College (GRCC) provides an email service for all students to use.

Upon enrollment, GRCC students are required to use this college issued account for all GRCC email correspondences (sending and receiving). This email account will be used for official notification by the college related to matters such as, but not limited to, financial aid, registration, and payments. The college will not respond to emails that are sent from current students' personal email accounts.

Disability Support Services

Students with disabilities who wish to request accommodations must be registered with the Disability Support Services Office (DSS) in Room 368 of the Student Center. You may contact DSS at (616) 234-4140 for more information. Once you are registered with the DSS Office, you will receive an *Accommodations Agreement* to present to me to verify your registration. Please see me as soon as possible so we may have a private conversation to discuss accommodations.

Student Code of Conduct

All GRCC students are held accountable to the Student Code of Conduct, which outlines expectations pertaining to academic honesty (including cheating and plagiarism), classroom conduct, and general conduct. The Code can be found in full at Student Code of Conduct.
**Add course/instructor specific implications of code violations*

Changes to the Syllabus

The instructor reserves the right to change the contents of this syllabus due to unforeseen circumstances. Students will be given notice of relevant changes in class, through a Blackboard Announcement, or through GRCC e-mail.

A. Automation in Manufacturing
    1. What is automation?
    2. How is automation used in manufacturing?
    3. Calculating costs of automation:
        - Throughput vs manual
        - Return on investment
    4. How is automation used in the industry?
    5. Weld fixtures and tooling

B. Robotic Programming
    1. Robot safety
    2. Teach pendant fundamentals
    3. Basic Robot operation
    4. Creating programs
    5. Programming, linear
    6. Circular interpolation
    7. Programming welding commands
    8. Basic robot setup
        - Labeling digital inputs
        - Labeling Digital outputs
        - Labeling timers
        - Labeling key functions
    - Connecting welding machines through arc link
    - Editing programs for efficiency
    9. How to setup a weld schedule
    10. Backing up programs to a memory card
    11. Weaving fundamentals.
    12. Setting up a jog frame
    13. Wait and timer instructions
    14. Program copy, delete, comment and write protect
    15. Zero program
    16. How to setup a tool center point
    17. How to setup Torchmate
    18. Operator control stand setup and operation
    19. Home program
    20. Emergency stop recoverery

C. Technical report writing
    1. Written report on each lab

D. Group Work
    1. Final presentation

Cycle Time Analysis

Time, money, process

What is it?

- Cycle time analysis is a technique that examines the total length of time an activity needs to complete its cycle.
- In the case of welding it is a start to finish time for a part to be made.
- it also breaks the cycle down into steps for further analysis

Breakin it Down

- Arc on time
  - actual weld time
- Robot movement time
  - robot movement from joint to joint
- Positioner time
  - positioner movement to its zero position at the end of the cycle
- Station interchange time
  - the robots movement to the second work station

How is it used?

It breaks down the process of welding a part into steps. Each step is then analysed to see where time can be saved or something can be done more efficiently.

- lower cycle times
- uncover lost capacity
- increase production throughput

Benchmark Cycle Time

- the cycle time you want to attain as much as possible
- least amount of down time
- least amount of work stoppages
- ideal cycle time

Creating a Benchmark Cycle Time

- first record the time, from start to finish, it takes to make a part. do this for an entire shift to acquire a range of cycle times.
- with all the cycle times collected you can now find the average, median, and mode of your data.

Creating a Benchmark Cycle Time

- you find the average by adding all the cycle times together and then dividing that sum by the number of cycle times you added together.
- to find the mode you find which time is repeated the most.
- the median is found by organizing all the cycle times from lowest time to highest time, and finding cycle time that is in the middle.

Creating a Benchmark Cycle Time

lets say our cycle times were as follows..
2:00, 2:30, 2:50, 2:30, 2:70, 3:40, 2:30

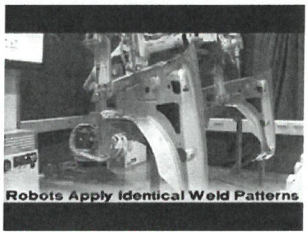
- the average would be 2:50
- the mode would be 2:30
- the median would be 2:30

2, 2.3, 2.3, 2.3, 2.5, 2.7, 3.4

Ways to Lower Cycle Times

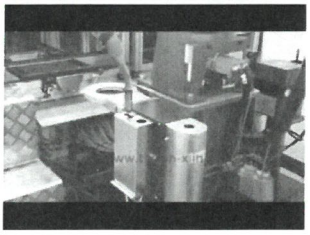
- What are the causes of the higher cycle times
- What are the causes of work stoppage
- Can new equipment decrease time?
  - is the equipment cost effective?

Equipment That Lowers Cycle Time



Robots Apply Identical Weld Patterns

Equipment That Lowers Cycle Time



References

http://www.youtube.com/watch?v=B8Pkp7OhwPg
http://www.youtube.com/watch?v=Q97rYg3nIPQ
http://www.robotwelding.co.uk/robot-cycle-times.html
http://www.theweldingwire.com/_cycle_times.html
http://asq.org/service/body-of-knowledge/tools-cycle-time-analysis

End of Arm Tooling

End of Arm Tooling

- End of Arm Tooling (EOA) can be described as any type of object connected to the robot wrist that serves a function.
- They may include but not limited to: Grippers, paint guns, rotating joints, deburring tools, drilling, nut runners, and welding devices

End of Arm Tooling

- Tools may be flexible or modular. It can be reconfigured easily and used for more than one task
- Tools may also be designed to only be used to complete one task.
- All tools should have some adjustability built into them to account for part variation.

End of Arm Tooling

- Grippers may be controlled by simple pneumatics, hydraulics, or servo motors.
- Grippers are capable of gripping, lifting, and releasing parts.
- Grippers should have part presents sensors and clamp sensors. These sensors are typically tied to robot inputs and work along with PLC's.

End of Arm Tooling

- Tooling weight must be kept to a minimum and also account for part weight. Robots have maximum payload capacities.
- Robot guarding must keep the loss of part control within safe confines from people
- Fanuc heavy payload robot
- http://www.youtube.com/watch?v=4VJL-58Vnlk

End of Arm Tooling

- Tooling weight must be kept to a minimum and also account for part weight. Robots have maximum payload capacities.
- Robot guarding must keep the loss of part control within safe confines from people
- http://www.youtube.com/watch?v=xoJ_L-KgdhY

End of Arm

- Fanuc Vision
- http://www.youtube.com/watch?v=Ec3Vf8Ip4Ic&list=UU1FuphciagC13Oz__5UPSYw&index=9

End of Arm Tooling

- Spot Welding
- http://www.youtube.com/watch?v=yyrOg-yqzog&list=UU1FuphciagC13Oz__5UPSYw

End of Arm Tooling

- Tools can be configured to be easily changed out via multiple tool changers as below:
- http://www.youtube.com/watch?v=gZCmLDK3E5s
- http://www.youtube.com/watch?v=4uVCGVrXZds

Positioners

BY GARY ALCUMBRACK AND AUSTIN CRAWFORD

Definition

- Any mechanical device or fixture, whose purpose is to securely hold and favorably position, a piece to be joined by welding.

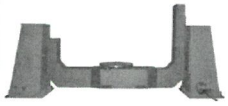
Types of Positioners

-Turntable type
-Headstock/tailstock type
-Other types include:

a) Universal balance
b) Drop center
c) Sky hook- 2 axis positioner
d) Combination
e) Specialty

Sky-hook

Drop-center



Universal-balance

Turntable

-Rotate on a central pivot point
-Also able to tilt on various axis
-Well suited for large weldments, circular welds, i.e. pipe and vessels

Video:
http://www.youtube.com/watch?v=Np-pukb4hmk

Headstock/Tailstock

-Similar to a lathe
-headstock is powered, tailstock only used for mounting purposes
-well suited for heavy pieces with a long axis
-often have multiple axis of movement

Video:
http://www.youtube.com/watch?v=Np-pukb4hmk
http://www.youtube.com/watch?v=dj9xz7W3gil

Other

-due to the great diversity of weldments, any number of specialized positioners are needed in the industry, to efficiently accomplish the welding tasks. No one positioner can meet all the requirements, therefore new positioners are constantly being made to meet the needs of the specific products.

Video:
http://www.youtube.com/watch?v=hFI1Po8Waj8

Advantages

-Efficiency
-Safety
-Cost savings
-Precision
-Optimal Weld position

http://www.youtube.com/watch?v=OV-5lGyDZg0

5 Main Considerations

1) **COG-Center of Gravity**

-Overall dimensions and weight

-distance from the positioners attachment to the floor, multiplies the stresses and torque on the apparatus

-overall dimensions impact the size requirements of the work cell

2) **Correct Attachment of the Weldment**

-must securely fasten the weldment to the positioner

-must take into account robotic movements

-must not collide with anything in the work-cell

-often accomplished using slots/bolts, or specialized clamps attached to positioner

-distortion of work piece must be taken into account

3) **Use of Turning Rolls**

-power rollers: control speed/stability

-idler rollers: keep piece stable

4) Keep it Flat!

-welding in the flat position, produces the highest % of successful welds

5) Ground Current

-usually the ground clamp is attached to the positioner

-it is preferable that the ground clamp be placed so that it does not need to be changed between welds

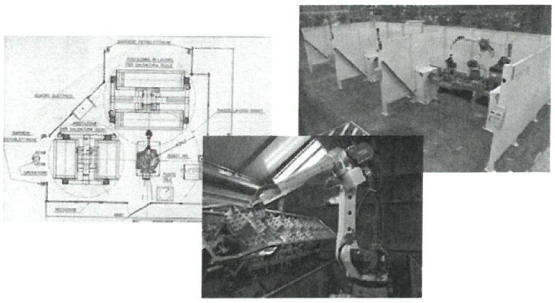
Manufacturers

- **KOIKE**
- **ALM**
- **WOLF**
- **GARNET**
- **ABB**
- **LJ**

Works Cited

- Images from google.com
- Videos from youtube.com
- Burgart, Donald R. "Fundamentals for Choosing a Positioner." *Aws.org*. American Welding Society, n.d. Web. 11 Nov. 2013.
- Ladd, Jason. "5 Things Welders Need to Know about Weld Positioners." *TheFabricator.com*. Fabricators & Manufacturers Association, Intl., 10 Sept. 2012. Web. 11 Nov. 2013.
- Davis, Dan. "Tons of Reasons for a New Welding Positioner." *TheFabricator.com*. Fabricators & Manufacturers Association, Intl., 9 Feb. 2010. Web. 11 Nov. 2013.

Robotic Weld Cell Layout



Robotic Weld Cell Layout

- SAFETY CONCERNS:
  - Every automation cell must conform to industry safety standards, MIOSHA, OSHA, and ANSI/RIA as some examples.
  - Entry points
  - Loading and unloading points
  - Guarding
  - Operational methods

ENTRY POINTS

- Typically cells are guarded with fencing around the perimeter to keep people away from automated systems
- Doors with interlock switches are typically used to enter the cell
  - These switches will stop robot operation
  - Allows a person to work on the robot but control should still be through a robot pendant

ENTRY POINTS

- Operator loading and unloading points
  - This area is used to interface with the automated equipment.
- Light curtains may be used to ensure the machine does not cycle when a person is present in the light curtain.
  - Typically the machine will not reset to the next cycle unless it "sees" the light break once

ENTRY POINTS

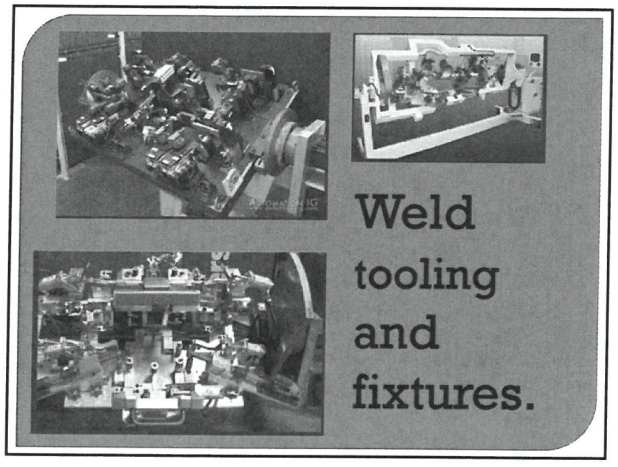
- Operator loading and unloading points
  - Safety Mats may also be used instead of light curtains.
  - Solid guards may also be used to isolate the operator from the moving equipment.
  - Laser scanners are a third option that ensures people are not in the way of moving equipment.

ENTRY POINTS

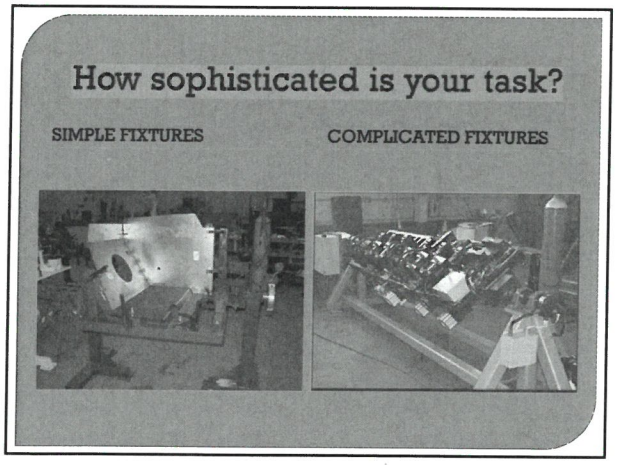
- Operator loading and unloading points
  - Do not reconfigure any system unless an engineer as looked over the changes
  - There are specific formulas related to operator safety, they include some of the following:
    - Speed of an individual, time for equipment to stop,
    - Time for equipment to sense a stop, ect.
  - Any and all changes must account for operator safety.

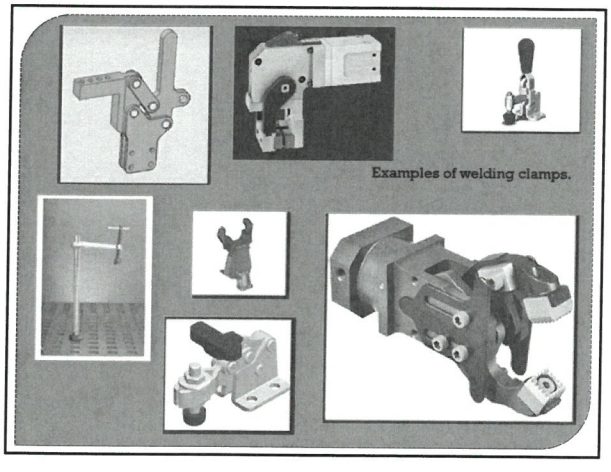
Cell Layout

- Size and layout of machinery
  - Smallest possible footprint to maximize space
  - Some shops mount items above the cell on a mezzanine, like welders, electrical panels ect.
  - The tradeoff is accessibility to the space , may not always be easy to work on equipment



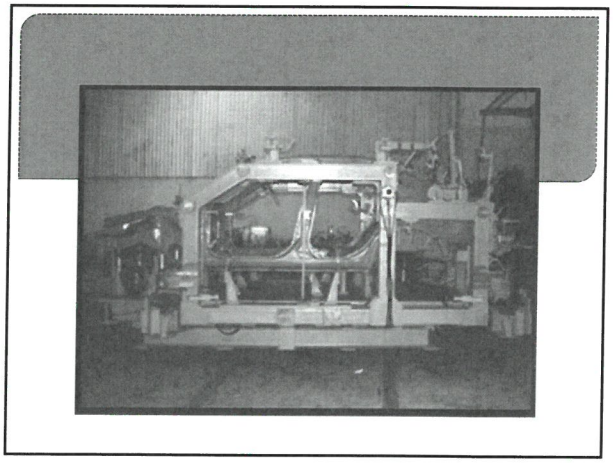
What is the definition of a weld fixture?



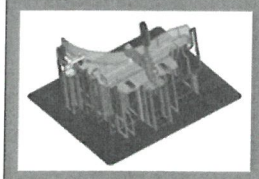
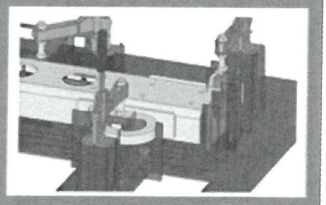
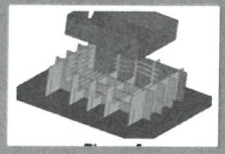
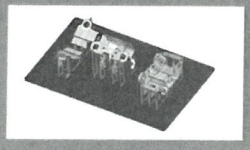


Choose your fixture material wisely.

	Mild Steel	Tool Steel	Aluminum - 6061	Stainless Steel	Copper / Copper Alloys
Material Cost	Low	Medium	Medium	High	High
Wear Resistance	Medium	High	Low	Medium	Low / Medium
Electrical Conductivity	Low	Low	Medium	Low	High
Thermal Conductivity	Low	Low	High	Low	High
Thermal Expansion	Low	Low	High	Medium	Medium



CAD FIXTURE DESIGN

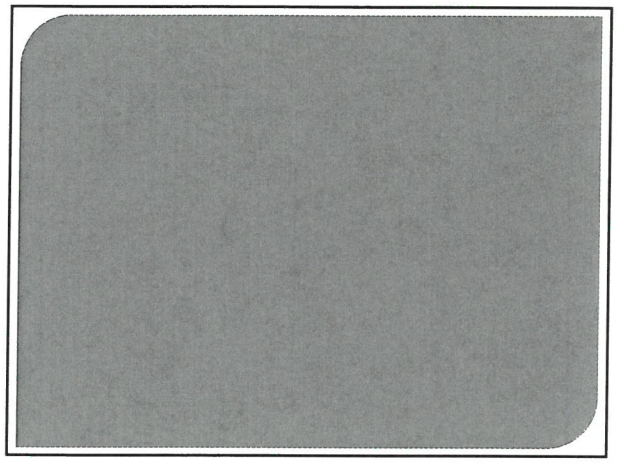
Manufactures of fixtures and tooling

weldsale

Randall Tool & Manufacturing

BTD First-class Metalwork For World-class Brands

SUMNER
SUMNER MANUFACTURING COMPANY INC.

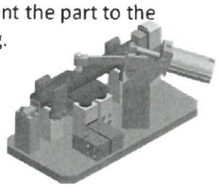


Automated Weld Tooling

MN233 Welding Automation

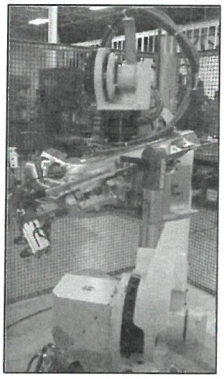
Automated Weld Tooling

- Weld Tooling, fixtures, jigs ect.
  - These terms are used interchangeably and are the most important interface between the automation and person.
  - Tooling is used to present the part to the automation for welding.



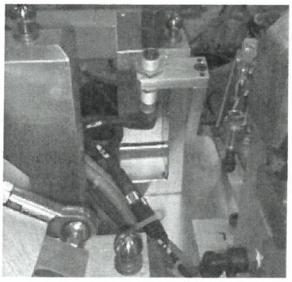
Important Factors for Tooling Consideration

- Welding Access
- Repeatability
- Operator Ergonomics
- Maintenance
- Quality / Ruggedness
- Sensors / Electrical
- Spatter Protection
- Adjustability



Welding Access

- Ensure the robot and torch have access to the weld joint. Clearance must be assessed for the following:
  - Clamps-tooling details, bolts ect.
  - Use a torch to mock up and check for clearance
  - Check sensor wires, hoses, and guarding for clearance
  - Many times a compromise must be made for access and torch angles or reach

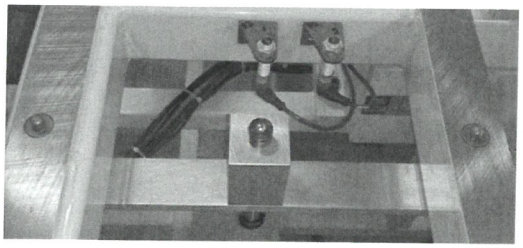


Welding Access

Notice the sensor wires and electrical cables. They must be routed to ensure welding access.

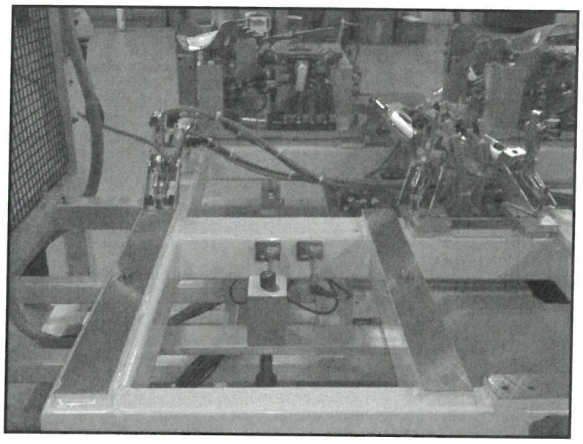
Repeatability

- Tools must return to the same positions each time
- Pins, clamps, details, location surfaces and locators must be checked for wear
- Any wear will allow the part to move and welds to be off location
- Tooling plates should use a location device to improve repeatability and usability.



Tool plate locators

Two and four way locators are used along with bushings to positively locate tool plates. This fixture also uses sensors for tooling identification.



Operator Ergonomics

- Tools must be designed to allow an operator to load and unload parts easily
- Things to consider: Tool height and necessary platforms, reach and bending to load and unload parts.
- Ejection cylinders or retracting pins to make unloading parts easy. Welded parts will distort and bind on pins.

Operator Ergonomics

- Reaching
- Bending
- Heavy lifting
- Using continuous force
- Working with vibrating equipment
- Repetitive motions
- Awkward postures
- Temperature

Maintenance

- Tools must be inspected at regular intervals
- Spatter must be cleaned from all surfaces
- Foreign material, grease, ect must be cleaned to prevent further build up.
- Check for operational effectiveness like clamping, sensors, and wearing of pins and surfaces.

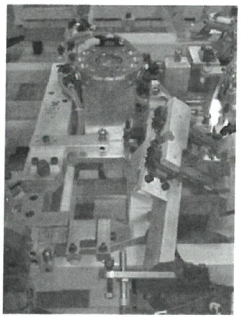
Quality / Ruggedness

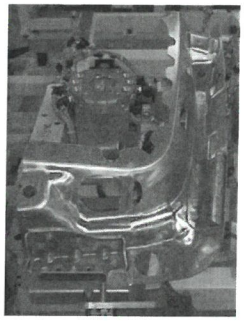
- Tools must be rugged and robust enough to work properly
- Tools must not flex or bend
- Paint marker and welding joints can be scribed to see if fixture flexes.
- Weld joints will not be repeatable if fixture is not strong or flexes.

Sensors / Electrical

- Sensors can be used for the following:
  - Part presence
  - Correctly loaded parts
  - Clamps opened or closed
  - Slides and cylinders extended or retracted
  - Part identification
  - Tool identifiction

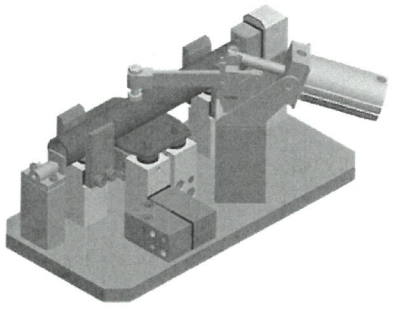
Sensors / Electrical





Spatter

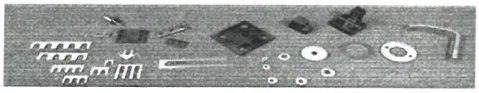
- Cylinder rods, guides, pins, slide rails, ect must all be guarded against spatter build up.
- Guards can block access so always check for interference.
- Spatter guards have to be used on all electrical and pneumatic lines.
- Part details can be coated or special material like Ampco Bronze can be used to reduce spatter from sticking to surfaces.

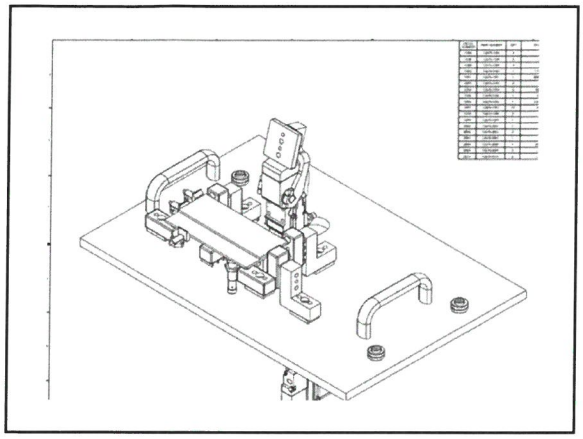


Adjustability

- As part tolerances stack up, there must be adjustability built in to the tool design.
- Standard NAAMS shims are easier to work with than laser cut shims
- Understand the direction of shimming to verify correct adjustment.

Shims





Subject Matter Expert (SME) Course Review Summary

College: Grand Rapids Community College

M-CAM Training Area: ☐CNC/Machining ☐Multi-Skilled/Mechatronics ☐Production Operation ☑Welding/Fabrication

Degree Program Name: Welding Technology

Title of Course: MN - 233 Welding Automation

Subject Matter Expert (SME) Reviewer Information

Name: Jon Althausen

Title: Technical Representative.

Phone: 724-705-3613

Email: Jalthausen@Lincolnelectric.com

Organization/Affiliation: Lincoln Electric

Attach Resume or provide credentials (showing years of experience and work experience that is relevant to course content):

Synopsis of Findings:

- this program looks great, just needs some more clarification on submerged arc welding.

Reviewers Signature _____ Date: 2/3/17

Michigan Coalition for Advanced Manufacturing
Subject Matter Expert Course Review

1. Course Overview and Objectives	Exceptional	Satisfactory	Ineffective
The goals and purpose of the course is clearly stated.		X	
Prerequisites and/or any required competencies are clearly stated.	X		
Learning objectives are specific and well-defined.	X		
Learning objectives describe outcomes that are measurable.	X		
Outcomes align to occupational focus (industry skills and standards).	X		
Comments or recommendations: There is a submerged arc lab (10%) of class score but it is not mentioned in outcomes / course information.			

2. Material and Resources	Exceptional	Satisfactory	Ineffective
The instructional materials contribute to the achievement of the course learning objectives.	X		
The materials and resources meet/reflect current industry practices and standards.	X		
The instructional materials provide options for a variety of learning styles.	X		
Resources and materials are cited appropriately. If applicable, license information is provided.	X		
Comments or recommendations:			

3. Learning Activities	Exceptional	Satisfactory	Ineffective
Provide opportunities for interaction and active learning.	X		
Help understand fundamental concepts, and build skills useful outside of the learning object.	X		
Activities are linked to current industry practices and standards.	X		
Comments or recommendations:			

Michigan Coalition for Advanced Manufacturing
Subject Matter Expert Course Review

4. Assessment Tools/Criteria for Evaluation	Exceptional	Satisfactory	Ineffective
The course evaluation criteria/course grading policy is stated clearly on syllabus.		X	
Measure stated learning objectives and link to industry standards.	X		
Align with course activities and resources.	X		
Include specific criteria for evaluation of student work and participation.	X		
Comments and recommendations: SAW lab not mentioned in course outcomes			

5. Equipment/Technology	Exceptional	Satisfactory	Ineffective
Meets industry standards and needs.	X		
Supports the course learning objectives.	X		
Provides students with easy access to the technologies required in the course/module.	X		
Comments and recommendations:			

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warrantees, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

4150 Piute Dr SW (724) 705-3613
Grandville, MI 49418 althausenj@gmail.com

Jonathan M. Althausen

OBJECTIVE

To obtain an opportunity in Sales Engineering that utilizes a determined individual with strong interpersonal and problem solving skills

EDUCATION

Grove City College Grove City, PA 2007-2011

B.S. Electrical Engineering

- 4 year ABET Accredited Electrical Engineering School
- QPA- 3.4/4.0 Major GPA 3.4/4.0 ~ *Cum Laude, Honors*
- Dean's List: Fall: 2009, 2010 Spring: 2008, 2009, 2010, 2011

WORK EXPERIENCE

The Lincoln Electric Company Cleveland, OH June 2011 - Present

Technical Sales Representative

- Graduated first place of technical sales training program with the Lincoln Electric Company
  - Competed against other engineers in a rigorous eight month program
  - Evaluation based on written exams, welding skills, presentations, leadership, and teamwork
- Given responsibility to handle a $6 million dollar sales territory based out of the Pittsburgh District Office
- Given responsibility to handle a $10 million dollar sales territory based out of the Grand Rapids Office
- Interacted with large end users such as Caterpillar, General Electric, and SMS Millcraft
- Gained technical expertise on product line and industry to educate and support distributor salesmen
- Provided lectures on advanced welding technology to vocational high schools and community colleges
- Facilitated cost savings and productivity increases for customers using innovative methods and technology
- Managed and completed sales of large capital equipment up to $230,000
- Provided cost saving reductions for end users totaling $720,000

INTERNSHIPS

Bechtel Plant Machinery Inc. Monroeville, PA May 2010 - August 2010

Electrical Engineering Intern

- Reviewed fuse evaluations to ensure the proper fuse was installed in rod position indication equipment.
- Analyzed fuse data sheets and utilized circuit analysis to aid in the selection process.
- Composed a failure analysis of power conversion equipment. Trended data using Excel spreadsheets.
- Helped create a template for a failure database and populated the database with failed components.
- Wrote an article for the company newsletter, a newsletter that is distributed to over 800 employees.

LEADERSHIP

Skills USA Michigan State Chair October 2013 - Present

- Oversee the state of Michigan welding competition for high school students
- 80 student compete for a chance to represent the state of Michigan at the national competition
- Oversee 25 volunteers, manage non-profit budget and projects

American Welding Society-West Michigan Board Member November 2013 - Present

- Coordinated and facilitated technical meeting gathers
- Drive the future and goals for the organization
- Volunteer and aid in non-profit fundraisers for scholarships

TECHNICAL SKILLS

Languages: C++, Matlab, Assembly

Software: Microsoft Office, SAP, CRM, Visual Studio, PSPICE, Mathematica

Welding: Gas Metal Arc, Shielded Metal Arc, Gas Tungsten Arc, Submerged Arc, Flux Cored Arc, and Robotic