ABSTRACT

This document describes a demonstration program that developed secondary level competency-based instructional materials for industrial automation mechanics. Program activities included task list compilation, instructional materials research, learning activity packet (LAP) development, construction of lab elements, system implementation, certification test development and piloting, replication, and third-party evaluation. Following the seven-page final report, appendix I contains these materials: junior course outline and task list; senior course outline; staff information; floor plan and equipment list; and evaluation report. Appendix II contains key segments of the LAPs developed, which consist of lab activities, instructional aids, and support materials developed for the task list. Tasks are divided into these content areas: fluid power (tube line fabrication, pneumatics, hydraulic pumps, hydraulic valves, actuators, hydraulic circuits); mechanical power (bearings, clutches and brakes, couplings, fasteners, gears, v-belts and chains); machining (bench metals, lathe, vertical mill, horizontal mill, surface grinding, broaching); and metal fabrication (sheet metal, welding, oxyacetylene welding, shield metal arc welding, metal inert gas welding, tungsten inert gas welding). Each content area consists of 17 to 55 LAPs. Components of each LAP include performance objective, tasks, references, time range, and handouts. (YLB)
FINAL REPORT

INDUSTRIAL AUTOMATION
MECHANIC
MODEL CURRICULUM PROJECT

LIBBEY SKILL CENTER
TOLEDO PUBLIC SCHOOLS

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COOPERATIVE DEMONSTRATION GRANT
US DEPARTMENT OF EDUCATION
OFFICE OF VOCATIONAL AND ADULT EDUCATION
# V199A90063

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TABLE OF CONTENTS

FINAL REPORT
0 INTRODUCTION
0 PROGRAM DESCRIPTION
   NEED
   OBJECTIVES
0 PROGRAM MANAGEMENT
   STAFFING
0 PROGRAM COMPONENTS

0 APPENDIX I
   Junior Course Outline --Yellow
   Task List -- Blue
   Senior Course Outline -- White
   Staff Information -- Yellow
   Floor Plan and Equipment List -- Pink
   Evaluator’s Report -- Green

0 APPENDIX II
   Fluid and Mechanical Power Transmission LAPs -- Buff
   Machining LAPs -- Pink
   Fabrication LAPs -- Green
INTRODUCTION

The Toledo Public School's Libbey Skill Center Industrial Automation Maintenance Program, in partnership with the National Fluid Power Society, Fluid Power Educational Foundation and the State of Ohio Department of Vocational Education, conducted a demonstration program under a grant awarded by the U.S. Department of Education. This eighteen month project ran from January 1, 1989 through June 30, 1990.

This Cooperative Demonstration Grant had as its goal the development of competency-based instructional materials for Industrial Automation Mechanics (IAM). These mechanics are responsible for installing, operating, and maintaining high-tech industrial equipment systems and processes. This curriculum is an educational foundation under the professional certification system being developed and administered by the cooperating private sector professional organizations. The targeted populations to utilize this instructional package are secondary vocational students preparing to enter the work force and adults needing technical training and update. Theory and practice will be integrated into a self-paced, individualized, experiential competency-based learning system.

The cooperating private sector partners had requested the development of this program for industrial mechanics. They took an active part in the grant program with major professional and economic responsibilities for the development of a mechanic certification test.

PROGRAM DESCRIPTION

NEED

Securing competent industrial automation mechanics is becoming more and more difficult. The increased application of "High Technology" in today's automated factories has significantly changed the job description for an industrial maintenance mechanic. The reason for the changing job description is the increased automation on today's factory floor. Islands of automation have been integrated into complex networks. No longer can one machine stand alone without affecting the entire system. The Center for Occupational Research and Development has stated that "to maintain and repair the new sophisticated systems requires an interdisciplinary team approach. Therefore, the industrial mechanic has become a member of a systems analysis team composed of mechanics, technicians and engineers. The new job description requires a multi-craft mechanic with broad-based competencies."
Mechanics with interdisciplinary skills and knowledge must be prepared through well-designed programs that include the broad knowledge base required to apply the needed interdisciplinary skills. Therefore, it is important that a channel for prospective mechanics be established that would enable them to be certified and enter the industrial maintenance trade at a known level. The preparation of industrial mechanics is a key issue to the growth of high-tech industries in the United States thereby creating a need for systematic training dedicated to producing industrial automation maintenance professionals.

PROGRAM OBJECTIVES

In this private/public sector endeavor each partner supported the other's strengths. The private sector developed a certification exam for entry level industrial mechanics and a testing network. The public sector (Libbey Industrial Automation Program) developed an instructional system to support the National Industrial Mechanic Certification exam. In order to accomplish this goal the following seven objectives were identified:

1. Develop task list and competencies required for entry level industrial maintenance mechanics.

2. Develop an educational delivery system which maximized individualized learning systems and flexible scheduling to accommodate adult as well as secondary students.

3. Pilot certification testing with students who have participated in prototype curriculum.

4. Development and refinement of a replicable curriculum/lab educational package for piloting by the Ohio State Department of Vocational Education.

5. Assist students in career decision-making through the utilization of a vocational assessment instrument.

6. Dissemination of curriculum materials to be made available through private/public sectors participating in this demonstration project.

7. Guidelines for an accreditation system for both program and instructor will be developed.
PROGRAM MANAGEMENT

Staffing:

The staff included two full-time and six part-time employees. Resumes for the two full-time staff and the instructor are included in Appendix I.

Project Director: The Trade and Industrial Supervisor for Toledo Public Schools served in this position. He served as liaison between the Toledo Public School District and the Ohio State Department of Vocational Education on a 10% FTE cost share basis. The Project Director also was responsible for budget allocations.

Project Facilitator: The President of Buckeye Educational Systems, a private consulting firm located in Lexington, OH., had responsibility for hiring the Curriculum Specialist, Lab Assistant, and part-time assistance (student help and word processing person. He also managed the budget allocated to the consulting firm as well as the vocational assessment component.

Project Coordinator: The Libbey Skill Center Industrial Automation Instructor's responsibilities were to direct the curriculum specialist, the lab assistant and coordinate with local and national advisory councils. Additionally, he piloted all materials and the instructional system with the students.

He served full time in the summer of 1989 on the grant. 50% FTE cost share during the regular teaching day for 15 months. In addition he volunteered 100% FTE during the summer of 1990 to assist in the completion of this work.

Curriculum Specialist: The Curriculum specialist was hired by the consulting firm for 100% FTE starting in April 1989 to carry out all project activities related to individualized instructional materials and the associated delivery system. She also had the responsibility of preparing quarterly and final reports.

Lab Assistant: The Lab Assistant was hired by the consulting firm for 15 months starting in June of 1989. His responsibilities included assisting with the development of storage and retrieval systems, instructional aids, and needed support items for the individualized learning system.

Word Processor: The Word Processor services were secured for the last two months of the grant to assist the curriculum specialist in final copy preparation.

Student Assistant: A student was hired for a few hours a day for six months for general assistance.
DISCUSSION OF PROGRAM COMPONENTS

PROGRAM DEVELOPMENT (OBJECTIVES 1 AND 2)

Phase I: Task List Compilation

Compiling of a task list for a cross trained industrial automation mechanics. The task list was researched from the following resources:

- National Fluid Power Society's Blue Ribbon Certification Committee
- Industrial references (Local)
- Regional vocational Curriculum Coordination Centers
- On site visits to other Industrial Automation vocational programs.

The established tasks were organized around seven duties identified by the private sector "Blue Ribbon Certification Committee":

- Preventive Maintenance
- Assemble Components
- Rebuild Components
- Replace Components
- Minor Repairs
- Major Repairs
- Trouble-Shooting

This task list is for the first year of study. See Appendix I for a listing of the tasks under the following content areas:

- Mechanical Power Transmission *
- Fluid Power Transmission *
- Machining
- Fabrication
- Electronics *
In our research we found the traditional industrial maintenance training programs were lacking in applied electronics (electro-hydraulics and electro-pneumatics), and in mechanical and fluid power transmission. It was determined by the advisory committee that an extensive electronic component as well as a power transmission (fluid, mechanical) core should be added to the overall program.

Phase II: Instructional Materials Research

A comprehensive materials (printed, visual and software) search was undertaken in an attempt to locate the most appropriate materials possible within the budget restraints. The instructor and curriculum specialist reviewed many material and instructional systems. When deemed feasible both high school and post-secondary students were asked to review materials before purchases were made. The carefully selected materials became an integral component of the instructional delivery system. Single concept video presentations were carefully selected to support the identified duties and tasks. Computer based instructional materials were secured to augment and maximize individualized learning system.

Phase III: Development of Learning Activity Packets (LAPs)

Generation of a bank of lab activities, instructional aids and support materials were developed for the task list. These materials were piloted with students throughout the 1989 - 1990 school year. Revisions, additions, and corrections were made before the final materials were prepared for this school year and inclusion in this report. See Appendix II for key segments of the Learning Activity Packets (LAPs).

Phase IV: Construction of Lab Elements

The key elements in an individualized instructional delivery system are visibility of all operations and processes that make up the learning environment. A workable storage and retrieval system was conceived and constructed. The labs were organized and developed to maximize ease of access. Color coding, distribution of materials to workstations and high visibility signage were utilized.

Phase V: System Implementation

Implementation, student adjustment and fine tuning of the system have just taken place with the beginning of this school year. The Instructor feels that student response has
been extremely positive. He has made the following observations:
  o an increase in average daily attendance,
  o number of tasks completed by each student for the first month of school,
  o positive self-management (time on task)
  o a sense of pride/ownership of the learning process
  o improved self-reliance and self-confidence

CERTIFICATION TEST DEVELOPMENT AND PILOTING (Objective 3)

The "Blue Ribbon Certification Committee" of the Fluid Power Society were responsible for development of the certification test and implementation of a testing system. Testing procedures have been developed. (This committee has contracted with Southern Illinois University to develop the Mechanics Level II Tests. This test will be composed of two parts: one in hydraulics and the other is pneumatics.) The Libbey IAM instructor participated in reviewing materials at several stages, and was invited to participate in a planning session for developing the testing system, during this past summer.

The concept of the certification test appears to be well received by the industrial mechanics, skilled trades associations and the maintenance managers. The projected date to begin testing is Fall of 1990.

REPLICATION (Objective number 4)

The Ohio State Department of Vocational Education has recently released a plan entitled "Action Plan for Accelerating the Modernization of Vocational Education in Ohio". The completion of this grant is timely as new approaches to instruction are important to this plan. The Assistant Director for Trade & Industrial Services has expressed that this grant report will be reviewed with utmost care and given highest consideration.

The instructor has already ben contacted by one Joint Vocational School to gain information for assisting them in establishing a similar program in their school.

Several members of the Fluid Power Society's "Blue Ribbon Committee" are working in their respective states with Vocational Directors to encourage the establishment of similar programs.
ASSESSMENT (Objective number 5)

The student interest skills survey was instituted as a way to provide students and their parents with information which would assist them in making good vocational choices. The Libbey students were piloted in November of 1989. The information gained from the survey will be beneficial in establishing baseline scores for future student testing.

DISSEMINATION OF CURRICULUM MATERIALS (Objective number 6)

Copies of this report will be available through the six regional Curriculum coordination Centers, the National Network for Curriculum Coordination in Vocational-technical Education, ERIC, and the Fluid Power Education Foundation. The Fluid Power Education Foundation has a "Key Schools" program across the country who will receive information regarding these materials which will be available from their office. The Trade and Industrial and Career Education Department of the Ohio State Department of Vocational and Adult Education will also receive materials for distribution.

ACCREDITATION SYSTEM (Objective number 7)

This endeavor was to be conducted by the private sector. Their board of directors made a decision to pass on this opportunity at this time due to legal liabilities.

THIRD PARTY EVALUATOR

The third party evaluator is highly regarded curriculum consultant with the Instructional Materials Laboratory at Ohio State University. She visited the program on four different occasions to observe the development of each phase of the developmental process. Her report is enclosed in the Appendix I.
APPENDIX I
INDUSTRIAL AUTOMATION/ROBOTICS

LIBBEY SKILL CENTER

TOLEDO, OHIO

JUNIOR COURSE OUTLINE

MONDAY - WEDNESDAY - FRIDAY

1st 9 WEEKS:
- Bench Metal
- Sheet Metal
- Mechanical Power Transmission

2nd 9 WEEKS:
- Lathe Turning
- Oxy-Acetylene and Shielded Metal Arc Welding

3rd 9 WEEKS:
- Lathe Turning, Milling, & Surface Grinding
- Metal Inert Gas Welding (MIG)
- Fluid Power Transmission

4th 9 WEEKS:
- Lathe Turning, Milling, Surface Grinding and Broaching
- Tungsten Inert Gas Welding (TIG)
- Fluid Power Transmission

TUESDAY - THURSDAY

1st 9 WEEKS:
- Tech Math 1
- Electronics 1
- Blueprint Reading/Sketching 1

2nd 9 WEEKS:
- Tech Math 2
- Electronics 2
- Blueprint Reading/Sketching 2

3rd 9 WEEKS:
- Tech Math 3
- Electronics 3
- Blueprint Reading/Sketching 3

4th 9 WEEKS:
- Tech Math 4
- Electronics 4
- Blueprint Reading/Sketching 4
JUNIOR COURSE DESCRIPTION

MACHINING (50 TASKS)

Bench Metal  
Introduction to precision layout and measurement, hand and power tool usage (10 Tasks)

Lathe Turning  
Facing, Turning to size, Taper Turning, Knurling, Threading, and Boring (20 Tasks)

Vertical/Horizontal Milling  
End, Side, and Pocket Milling, Boring and Precision Drilling (18 Tasks)

Surface Grinding  
Flat, end and Edge Grinding (1 Task)

Broaching  
Hand Broaching on Arbor Press (1 Task)

METAL FABRICATION (32 TASKS)

Sheet Metal  
Shearing, bending, joining flat, round and angle stock (9 Tasks)

Oxy-acetylene Welding and Cutting  
Butt, lap, tee joints in flat position, brazing, piercing and cutting to specification (6 Tasks)

Shielded Metal Arc Welding (SMA)  
Beading, butt, lap, tee joints in flat position (6 Tasks)

Metal Inert Gas Welding (MIG)  
Beading, butt, lap, tee joints in flat position (6 Tasks)

Tungsten Inert Gas Welding (TIG)  
Beading, butt, lap, tee joints in flat position (5 Tasks)

MECHANICAL POWER TRANSMISSION

Coupling Alignment  
Alignment of flexible and rigid couplings

Gears and Speed Reducers  
Identification, inspection and measurements of gears and gear driven speed reducers

Belt & Chain Drives  
Identification, Inspection and Measurement of belt and chain drives
Fasteners  Identification, inspection, and measurement of bolts, screws and assorted mechanical fasteners

Clutches & Brakes Identification, inspection, and measurement of various clutch and brake assemblies

Bearings Identification, inspection and measurement of plain and anti-friction bearings. Assembly and disassembly of press-fit bearings.

FLUID POWER TRANSMISSION

Hydraulic Pumps Identification and inspection of gear, vane and piston pumps

Hydraulic Valves Identification and inspection of pressure, flow, and directional valves

Tube/Hose Fittings Tube bending, hose assembly, identification of assorted fittings

Hydraulic Circuitry Build and test circuits on hydraulic trainer

Pneumatics Identification and inspection of pneumatic components

Pneumatic Circuitry Build and test circuits on pneumatic trainer

TECHNICAL MATH

Technical Math 1 Whole numbers

Technical Math 2 Fractions

Technical Math 3 Algebra

Technical Math 4 Geometry

BLUEPRINT READING/SKETCHING

Blueprint Reading/ Sketching 1 Technical Sketching

Blueprint Reading/ Sketching 2 Mechanical

Blueprint Reading/ Sketching 3 Fluid Power

Blueprint Reading/ Sketching 4 Electrical
ELECTRONICS

Electronics Level 1  Introduction to Electronic Components and Circuit Assembly
Electronics Level 2  AC/DC And the Fundamentals of Power Supplies
Electronics Level 3  Amplifiers and Oscillators
Electronics Level 4  Digital Electronics and Integrated Circuits

TIME SCHEDULE

SHOP WORK

MONDAY - WEDNESDAY - FRIDAY

11:35 A.M. DRESSED AND AT WORK STATION

2:05 P.M. INSPECTORS PUT THEIR TOOLS AWAY AND CHANGE CLOTHES

2:10 P.M. FABRICATION - CHANGE CLOTHES
MACHINING - CLEAN UP YOUR WORK AREA *
POWER TRANSMISSION - RETURN TOOLS

2:15 P.M. FABRICATION - CLEAN UP YOUR WORK AREA *
MACHINING - RETURN TOOLS
POWER TRANSMISSION - CHANGE CLOTHES

2:20 P.M. FABRICATION - RETURN TOOLS
MACHINING - CHANGE CLOTHES
POWER TRANSMISSION - CLEAN UP YOUR WORK AREA *

2:25 P.M. ENTER CLASSROOM TO RECORD ACCOMPLISHMENTS IN YOUR NOTEBOOK

* CLEAN UP YOUR WORK AREA:
  o BENCHES/TABLES/MACHINES CLEANED
  o RAGS RETURNED TO APPROPRIATE PLACE AT EACH WORKSTATION
  o FLOORS CLEANED

TUESDAY AND THURSDAY - ELECTRONICS, MATH AND BLUEPRINT READING/SKETCHING

11:35 A.M. TECH MATH
12:05 P.M. ELECTRONICS
1:50 P.M. BLUEPRINT READING AND SKETCHING
2:25 P.M. RECORD ACCOMPLISHMENTS IN YOUR NOTEBOOK
FORMAT FOR ALL WRITTEN WORK ASSIGNMENTS

NAME OF SUBJECT **

ASSIGNMENT # YOUR NAME

DATE______

○ USE A FULL SHEET OF PAPER FOR EACH EXERCISE

○ USE PENCILS ONLY

○ WRITE OUT EACH PROBLEM (THIS ALLOWS YOU TO PRACTICE YOUR TECHNICAL WRITING FORM)

○ CIRCLE ALL ANSWERS

○ SIGNAL YOUR INSTRUCTOR ***

○ PLACE EACH ASSIGNMENT SHEET IN THE PROPER SECTION OF YOUR NOTEBOOK

○ ALL WORK MUST BE COMPLETED AND IN APPROPRIATE SECTION AT THE TIME OF THE NINE WEEK TEST.

** Electronic, Tech Math 1-4, Blueprint Reading/Sketching 1-4, shop work LAP #

*** RED HELP BLUE CHECK MY WORK YELLOW I AM OK
PROCEDURES FOR SHOP WORK

MONDAY - WEDNESDAY - FRIDAY

0 YOU ARE TO BE DRESSED, WEARING SAFETY EQUIPMENT, AND AT
YOUR DESIGNATED WORK STATION WHEN THE TARDY BELL RINGS.

0 EACH WEEK THERE WILL BE A SAFETY INSPECTOR AND POSITION.
A TOOL ROOM INSPECTOR APPOINTED WITH AN ALTERNATE FOR
EACH. THE ALTERNATE WILL BECOME THE INSPECTOR THE NEXT
WEEK AND IN THE ABSENCE OF THE ASSIGNED INSPECTOR WILL
ASSUME THE RESPONSIBILITIES FOR THAT POSITION. THE CHART
POSTING THIS ASSIGNMENT IS IN THE SHOP.

JOB DESCRIPTIONS FOR THE INSPECTORS

SAFETY INSPECTORS:

0 OBSERVE SAFETY CONDITION DURING PREPARATIONS FOR WORK
AND PREPARATION FOR DISMISSAL:
  PROPER DRESS
  SAFETY GLASSES
  ORDERLINESS
  GENERAL CONDUCT

0 COMPLETE A DAILY SAFETY FORM AND FILE WITH THE
INSPECTOR

TOOL ROOM INSPECTOR:

0 INSPECT TOOL ROOM PRIOR TO USAGE AND AT THE END OF THE
DAY

0 COMPLETE DAILY TOOL ROOM REPORT AND FILE WITH THE
INSPECTOR.

STUDENT ORGANIZATION

0 THE CLASS WILL BE DIVIDED INTO THREE TEAMS. YOU WILL PLAN
WITH YOUR TEAM EACH NINE WEEK IN THE FOLLOWING THREE AREA:

  FABRICATION: SHEET METAL AND WELDING
  MACHINING: BENCH METAL, LATHES, MILLING, GRINDING &
  BROACHING
  POWER TRANSMISSION: MECHANICAL AND FLUIDS

YOU WILL WORK IN ALL AREA EACH NINE WEEKS.

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<tr>
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<th>FABRICATION</th>
<th>MACHINING</th>
<th>POWER TRANSMISSION</th>
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<tr>
<td>ROTATION 1</td>
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<td>Z</td>
<td>Y</td>
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<td>ROTATION 2</td>
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<td>ROTATION 3</td>
<td>Z</td>
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</table>

SEE EXAMPLES ON FOLLOWING PAGES FOR PLANNING IN EACH OF THE
AREAS PLANNING CHART.
**POWER TRANSMISSION PLANNING CHART**

You will work in Power Transmission 3 hours a day for 17 days during the first semester. This will be divided into two days at each bench with 5 extra days at the end of the semester for make up or for "Quest" work.

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<thead>
<tr>
<th>SUBJECT AREA</th>
<th>DAYS IN</th>
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<td>POWER TRANS.</td>
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<td>24&amp;26</td>
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<td>V. BELTS/CHAIN</td>
<td>J.E.</td>
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<td>CLUTCHES &amp; BRAKES</td>
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<td>BEARINGS</td>
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<td>COUPLING ALIGNMENT</td>
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<td>J.E.</td>
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<td>GEARS/SPEED REDUCERS</td>
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<td>FASTENER</td>
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*Note: The table continues with additional entries for each subject area.*
YOU WILL HAVE 9 DAYS IN THIS AREA. THE SECOND NINE WEEKS YOU WILL DIVIDE YOUR TIME BETWEEN OXY-A AND ARC.

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<thead>
<tr>
<th>FABRICATION</th>
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<tr>
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<td>5  7  9  12 14 16 19 21 26</td>
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<td>OXY-A # 1</td>
<td>JE  JE  JE</td>
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<td>ARC # 3</td>
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</table>
YOU WILL WORK IN THE MACHINE SHOP 3 HOURS A DAY FOR 18 DAYS DURING THE SECOND SEMESTER. YOU WILL SIGN UP FOR THE VERTICAL MILL AND THE HORIZONTAL MILL FOR TWO BLOCKS EACH BLOCK WILL BE TWO DAYS. THE OTHER DAYS YOU WILL BE WORKING AT A LATHE.

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<tr>
<th>SUBJECT AREA</th>
<th>MACHINE SHOP</th>
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<td>V. MILL</td>
<td>J.E. J.E.</td>
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<td>H. MILL</td>
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<td>LATHE # 1</td>
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<td>LATHE # 3</td>
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<td>LATHE # 4</td>
<td>J.E.</td>
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<td>LATHE # 4</td>
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FLUID POWER TRANSMISSION PLANNING CHART

YOU WILL WORK IN POWER TRANSMISSION 3 HOURS A DAY FOR 17 DAYS DURING THE FIRST SEMESTER. THIS WILL BE DIVIDED INTO 10 DAYS AT EACH BENCH WITH 5 EXTRA DAYS AT THE END OF THE SEMESTER FOR MAKE UP OR FOR "QUEST" WORK.

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<tr>
<th>DATE</th>
<th>HYDRAULIC PUMPS</th>
<th>HYDRAULIC PUMPS</th>
<th>TUBE/HOSE FITTINGS</th>
<th>HYDRAULIC CIRCUITRY</th>
<th>PNEUMATICS</th>
<th>PNEUMATIC CIRCUITRY</th>
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GRADING SYSTEM

80 % FROM DAILY WORK

- MATH 15 %
- BLUEPRINT READING/SKETCHING 15 %
- ELECTRONICS 15 %
- SHOP WORK 15 %
- WORK HABITS 20 %
  (Attitude, cooperativeness, staying on task)

20 % NINE WEEK TEST

EXAMPLE: FIRST NINE WEEKS

SHOP WORK: LAPS PROJECTED

FABRICATION - 9  MACHINE SHOP - 10  POWER TRANSMISSION - 12

<table>
<thead>
<tr>
<th>QUEST - A</th>
<th>QUEST - A</th>
<th>QUEST - A</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 LAPS - B</td>
<td>10 LAPS - B</td>
<td>12 LAPS - B</td>
</tr>
<tr>
<td>8 LAPS - C</td>
<td>9 LAPS - C</td>
<td>11 LAPS - C</td>
</tr>
<tr>
<td>7 LAPS - D</td>
<td>8 LAPS - D</td>
<td>10 LAPS - D</td>
</tr>
</tbody>
</table>

MATH: CALCULATIONS AND FORM (USE TECHNICAL STYLE OF WRITING)

16 ASSIGNMENTS - 16 = A, 15 = B, 14 = C, 13 = D

BLUEPRINT READING/SKETCHING:

16 ASSIGNMENTS - 16 = A, 15 = B, 14 = C, 13 = D

ELECTRONICS:

LEVEL I, 13 ASSIGNMENTS - QUEST = A, 13 = B, 12 = C, 11 = D

JOE SMITH HAS: "B" IN SHOP (B, C, & B) 3 POINTS
"C" IN MATH 2 POINTS
"A" IN BL.P/S 4 POINTS
"B" IN ELECTRONICS 3 POINTS
"B" IN WORK HABITS 3 POINTS

80 % DAILY WORK 15 POINTS TOTAL

15 DIVIDED BY 5 = 3 FOR A "B" ON DAILY WORK

20 % NINE WEEKS TEST "C"

DAILY WORK 3 POINTS X 4 **** (80%) = 12
NINE WEEKS TEST 2 POINTS X 1 (20%) = 2
TOTAL POINTS 14 DIVIDED BY 5 = 2.8

THEREFORE THE NINE WEEK GRADE IS A "C+"

**** 80% = 4/5 20% = 1/5
SAFETY INSPECTOR'S REPORT

DATE:__________ INSPECTOR: ________________

OBSERVATIONS:

SAFETY APPAREL

GLASSES __ EVERYONE OKAY
REMINDED ____________ & ____________

LEATHER SHOES __ EVERYONE OKAY
REMINDED ____________ & ____________

SHIRT TUCKED-IN __ EVERYONE OKAY
REMINDED ______ ______ & __________

LOCKER AREA

ORDERLINESS OF DRESSING AREA __ OKAY
REMINDED ______________ & __________

CLEANLINESS OF SINK AREA __ OKAY
REMINDED ______________ & __________

LOCKERS ARE TO BE USED ONLY FOR ITEMS RELATED TO SHOP WORK __ OKAY
REMINDED ______________ & __________

SHOP AREA

FLOOR FREE OF HAZARDS __ OKAY
REMINDED ______________ & __________

EQUIPMENT OILED & CLEANED __ OKAY
REMINDED ______________ & __________

WORK BENCHES CLEARED & CLEANED __ OKAY
REMINDED ______________ & __________
TOOL ROOM INSPECTOR'S REPORT

DATE: _______________ INSPECTOR ________________________

PRE USAGE CHECK:

1. TOOLS __ OKAY OR
   A. MISSING __________, __________ & __________
   B. DIRTY __________, __________ & __________
   C. DAMAGED __________, __________ & __________

2. COUNTER CLEAR 7 CLEAN __ OKAY OR ______

3. FLOOR __ OKAY OR ________________________

4. ELECTRIC CORDS CORRECTLY WRAPPED __ OKAY
   OR ________________________________

POST-USAGE CHECK:

1. TOOLS __ OKAY OR
   A. MISSING __________, __________ & __________
   B. DIRTY __________, __________ & __________
   C. DAMAGED __________, __________ & __________
   D. BROKEN __________, __________ & __________

2. COUNTER CLEAR 7 CLEAN __ OKAY OR ________________

3. FLOOR __ OKAY OR ________________________________

4. ELECTRIC CORDS CORRECTLY WRAPPED __ OKAY
   OR ________________________________

5. WHO DID YOU HAVE TO REMIND ________________ &
   ________________ & ________
TASK LIST
MISSION STATEMENT:

To prepare entry level industrial mechanics to maintain, install, and repair high-tech automated machine systems.

VOCATIONAL DUTIES:

PREVENTIVE MAINTENANCE
ASSEMBLE COMPONENTS
REBUILD COMPONENTS
REPLACE COMPONENTS
MINOR REPAIRS
MAJOR REPAIRS
TROUBLE-SHOOTING

TASKS FOR FIRST YEAR:

Begin on the next page
INDUSTRIAL AUTOMATION MAINTENANCE/ROBOTICS INDIVIDUALIZED CURRICULUM PLAN

FIRST YEAR

FOUR AREAS OF INSTRUCTION

ELECTRONICS 144 hrs.

4 LEVELS
Electronic Components and circuits assembly
DC/AC and Power Supplies
Solid-State Amplifiers and Oscillators
Digital Electronics and Integrated Circuits

RELATED 72 hrs.
Blueprint Reading
Shop Math

FABRICATION 108 hrs.
Sheet Metal
Welding
Shielded Metal Arc
Oxy-acetylene
Welding
Brazing
Flame Cutting
Metal Inert Gas
Tungsten Inert Gas

MACHINE SHOP 108 hrs.

Bench Metals
Lathes
Milling
Vertical
Horizontal
Broaching
Surface Grinding

POWER TRANSMISSION 108 hrs.

Mechanical
Bearings
Clutches/Brakes
Coupling Alignment
Fasteners
Gears/speed Reducers
V-belts/Chains

Fluid Power
Pneumatic - Hydraulic
Actuators
Circuits
Cylinders
Filtration
Lines/Fittings
Motors
Pumps
Sealants
Troubleshooting
Valves

Each student will rotate through all areas each nine weeks.

M - W - F = Fabrication, Machine Shop and Power Transmission
(9 days in each area per nine weeks)
T - TH = Electronics and Related
METAL FABRICATION

SHEET METAL

LAP 0 SAFETY - Measurement

LAP 1 Perform layout, hand shearing, and hand punching on flat sheet stock

LAP 2 Demonstrate proper techniques for straight, V, and slant notching

LAP 3 Perform layout and cutting to specifications
Perform outside seam, inside seam, and groove seam to specifications
Perform spot seld and op rivet to specifications

LAP 4 Construct sheet metal rectangular box to specification

LAP 5 Construct coupling guard to specification

LAP 6 Construct round pipe with 1/4" groove seam to specifications

LAP 7 Perform bending of flat stock to angular specifications

LAP 8 Construct 90 degree angle iron mitered corner

LAP 9 Form "U" bolt from 3/8" round stock to specifications

WELDING

LAP 0 SAFETY - Metal Identification - Tool Identification and Location

OXY-ACETYLENE

LAP 0 SAFETY and Set-up for Oxy-acetylene

LAP 1 Produce stringer beads in flat position without and with the use of a filler metal

LAP 2 Produce quality lap joint fillet welds in flat position

LAP 3 Produce quality square groove weld on a butt joint in the flat position using the keyhole technique

2 28
LAP 4  Produce brazed butt joint
LAP 5  Produce a brazed pipe joint
LAP 6  Produce quality square bevel and a circular flame cut edges

**SHIELD METAL ARC**

LAP 0  State SAFETY procedures

Utilize simulator to practice angle, distance and speed of the electrode in relationship to the work piece

LAP 1  Demonstrate ability to adjust machine settings, strike an arc, manipulate the electrode, and read the puddle to produce button beads

LAP 2  Produce short beads on flat surface
LAP 3  Produce a pad of beads in flat position
LAP 4  Produce a fillet weld lap joint
LAP 5  Produce square groove butt joint in horizontal position
LAP 6  Produce fillet weld (3 bead) Tee joint in horizontal position

Perform visual inspection

**METAL INERT GAS WELDING (MIG)**

LAP 0  State SAFETY Rules and procedures

Demonstrate equipment setting

Practice on simulator feed, speed, and angel

LAP 1  Produce button beads in flat position
LAP 2  Produce a quality short beads in flat position
LAP 3  Produce a quality outside corner joint in flat position
LAP 4  Produce a quality lap joint in flat position
LAP 5  Produce a quality butt joint
LAP 6  produce a quality Tee joint in flat position
TUNGSTEN INERT GAS

LAP 0  State SAFETY rules and set-up procedures

  Practice on simulator for feed, speed, angle

LAP 1  Produce short beads in flat position on aluminum stock

LAP 2  Produce outside corner joint in flat position on aluminum stock

LAP 3  Produce quality lap joint in flat position on aluminum stock

LAP 4  Produce quality butt joint in flat position on aluminum stock

LAP 5  Produce quality Tee joint in flat position on aluminum stock

MACHINE SHOP

BENCH METALS

LAP 0  SAFETY - Measurement - Tool identification and location

LAP 1  Demonstrate the ability to use a steel ruler in graduations up to 1/32", (utilizing a linear and circular measurement kit), within a tolerance of +1/32".

LAP 2  Demonstrate ability to use a hook ruler to measure linear and circular items with a tolerance of + - 1/32"

LAP 3  Demonstrate the ability to use a steel ruler set CALIPERS and take inside/outside measurements of designated materials with a tolerance of + - 1/32"

LAP 4  Demonstrate use of a combination square to take measurement and perform a layout to specifications within a tolerance of + - 1/32"

LAP 5  Demonstrate the ability to set and use a dial calliper for outside, depth, and inside measurements within a tolerance of + - .010
LAP 6  Demonstrated the ability to create a precision layout according to given to specification, within a tolerance of + - 1/32", + - 1 degree

LAP 7  Demonstrate the ability to fabricate the layout completed in LAP 6 using hand tools and pedestal grinder to within + - 1/32" or + - 1 degree of specifications

LAP 8  Demonstrate the ability to read layout specifications, and perform layout techniques for hole conditioning, within a tolerance of + - 1/32"

LAP 9  Demonstrate the ability to read layout specifications, and perform countersinking and counterboring operations, within a tolerance of + - 1/32" (from LAP 8)

LAP 10 Demonstrate the ability to read layout specifications, and perform a tapping operation within a tolerance of + - 1/32", + - 1 degree

LATHES

LAP 0  State SAFETY rules

Identify major parts and accessories of an engine lathe

State rules for use, care and cleaning of the engine lathe

Use shop formulas and charts to determine lathe speeds, feeds and depths of cuts

LAP 1  Demonstrate the ability to face an aluminum part to specified length with + - .001 tolerance

LAP 2  Perform a straight turning operation of aluminum stock to specifications + - .001 tolerance

LAP 3  Face a steel part to specified length within + - .001 tolerance

LAP 4  Perform a straight turning operation on steel to specifications within + - .001 tolerance

LAP 5  Turn square shoulder to length as specified + - .001 tolerance

LAP 6  Use dial indicator to align work in four-jaw chuck
Perform champher operations to specifications
Perform recessing operations to specifications
Perform center-drilling operations to specifications
Perform knurling operations to specifications
Perform drilling and reaming operations to specifications
Perform tapping operations to specifications
Perform cut-off operation to specifications
Perform turning between centers operation to specifications
Perform a taper with taper attachment
Perform taper turning with a compound to specification
Perform boring operation to specifications
Cut external threads to a relief as specified
Perform thread pick up to specification
Perform internal thread cutting to specifications

**MILLING**

**Vertical**

Demonstrate knowledge of SAFETY procedures regarding vertical milling
Identify vertical milling machine controls
Define vertical milling operations

Mount and remove cutter and cutter holder as specified

Demonstrate use of specified machine controls

Mount and align vise as specified to within a + - .001 tolerance

Align head square to table as specified to within a + - .001 tolerance
LAP 5  Demonstrate squaring stock to size as specified
LAP 6  Perform hole conditioning to specifications
LAP 7  Perform specified side milling operation to within 
       + - .010 tolerance
LAP 8  Perform end milling operation to specifications 
       within + - .010 tolerance
LAP 9  Mill keyseat with keyseat cutter and a key slot 
       with end mill to specifications within a tolerance 
       of + - .010
LAP 10 Mill a rectangular slot to specifications within a 
       tolerance of = - .010
LAP 11 Perform precision locating drilling, and reaming 
       of holes to specification within a tolerance of 
       + - .001
LAP 12 Demonstrate ability to align a bore concentric to 
       the spindle as specified
LAP 13 Perform a boring operation to specifications within 
       a tolerance of + - .003

Horizontal
LAP 0  Demonstrate knowledge of SAFETY, procedures 
       regarding horizontal milling
LAP 1  Demonstrate mounting of an arbor to specifications
LAP 2  Demonstrate mount cutter to arbor as specified
LAP 3  Demonstrate alignment of a vise as specified
LAP 4  Demonstrate ability to mill a square to 
       specifications within + - .010 tolerance
LAP 5  Demonstrate ability to mill a key slot to 
       specification within tolerance of + - .010

SURFACE GRINDING
LAP 0  State SAFETY procedures related to surface grinding
LAP 1  Surface grind a work piece square and parallel
BROACHING

LAP 1 Perform hand broaching operation to cut an internal keyway

POWER TRANSMISSION

MECHANICAL

LAP 0 SAFETY - Measurement - Tool Identification and location

Clutches - BRAKES

LAP 1 Identify, disassemble and assemble a one way positive engagement clutch

LAP 2 Disassemble, sketch, measure, and reassemble a clutch and a brake assemblies

LAP 3 Inspect, disassemble, repair and reassemble a QD Hub on a clutch/brake assembly

Gears/Speed Reducers

LAP 1 Identify, measure and size major types of gears utilizing manufactures specifications

LAP 2 Demonstrate disassembly, calculate ratio, and reassemble a compound gear train

LAP 3 Disassemble, inspect, assemble and test speed reducer (count and calculate ratio - inspect)

Bearings

LAP 1 Identify major types of bearings and figure load

LAP 2 Install and remove plain and anti-friction bearings with the Mechanical Arbor Press

LAP 3 Disassemble, inspect, reassemble a speed reducer with three types of bearings

Coupling Alignment

LAP 1 Assemble and align a flexible (chain type) coupling using a feeler gauge and straight edge
Fasteners

LAP 1  Demonstrate ability to identify and measure machine bolts and screws

LAP 2  Perform a layout from blueprints

Perform a drilling operation to layout specifications

Tap external and internal threads

Repair damaged threads

Remove a broken bolt/screw

LAP 3  Assemble and disassemble component parts requiring torque

V-Belts and Chains

LAP 1  Identify type of chains

Size chain and sprockets

Calculate the speed ratio of given chain/sprocket

LAP 2  Disassemble a chain drive assemble

Identify and measure chains and sprocket to calculate speed ratio

Reassemble and realign the sprockets and tension the chain

LAP 3  Identify, size, align and tension a V-Belt

FLUID POWER

LAP 0  SAFETY, Tool Identification and Location

PNEUMATICS

LAP 1  Disassemble, inspect and assemble filter, regulator and lubricator unit

LAP 2  Disassemble, inspect and assemble a pneumatic directional control valve
LAP 3  Disassemble, inspect and assemble a pneumatic cylinder
LAP 4  Disassemble, inspect and assemble pneumatic motor
LAP 5  Disassemble, inspect and assemble a pneumatic hand tool
LAP 6  Assemble, verify and troubleshoot air logic system

PUMPS
LAP 1  Disassemble, inspect and reassemble a gear pump
LAP 2  Disassemble, inspect and reassemble a vane pump
LAP 3  Disassemble, inspect and reassemble a piston pump
LAP 4  Test vane pump for mechanical and volumetric efficiency

ACTUATORS
LAP 1  Disassemble, inspect and reassemble a hydraulic cylinder

TUBE LINE FABRICATION
LAP 1  Layout and bend tubing to specifications
LAP 2  Identify and measure various types of fittings commonly used with tubing
LAP 3  Cut, flare, fit tube to fittings
LAP 4  Install and test tube line fabrication to pneumatic power supply

HOSE ASSEMBLY
LAP 1  Identify and measure various types of hose-ends used in hydraulic systems
LAP 2  Identify and measure various types of fittings used in hydraulic systems
LAP 3  Crimp hose ends and fittings on hydraulic hose
LAP 4  Install and test hose assemble on hydraulic power supply
LAP 5  Cut, thread and fit pipe
LAP 6  Install pipe assemble according to schematic

CIRCUITS

LAP 1  Demonstrate basic linear hydraulic circuit
LAP 2  Demonstrate regenerative circuit
LAP 3  Demonstrate sequencing circuit
LAP 4  Demonstrate sequencing circuits with limited clamping pressure
LAP 5  Demonstrate counterbalance circuit
LAP 6  Demonstrate hydraulic circuit with speed control
LAP 7  Demonstrate traverse and feed circuit
LAP 8  Demonstrate sequencing circuit with speed control
LAP 9  Demonstrate basic hydraulic rotary motion circuit
LAP 10 Demonstrate hydraulic rotary drive with speed control
LAP 11 Troubleshoot hydraulic circuit

VALVES

LAP 1  Disassemble, inspect, assemble and test pressure control valves
LAP 2  Disassemble, inspect, assemble and test flow control valves
LAP 3  Disassemble, inspect, assemble and test directional control valves
LAP 4  Given a defective hydraulic valve, locate necessary information for order replacement parts
ELECTRONICS

LAP 1 Identify resistors using color code
LAP 2 Connect LEDs in simple circuit
LAP 3 Connect seven segment display in circuit
LAP 4 Connect transistors in a switching circuit
LAP 5 Connect transistors in a switching circuit
LAP 6 Connect the SCR in a latching circuit
LAP 7 Connect the 555 Timer IC in a timer circuit
LAP 8 Vary the values of resistors to control the timer
LAP 9 Observe voltage as a result of current change
LAP 10 Observe change current as resistance changes
LAP 11 Connect a transformer to step-up voltage
LAP 12 Connect a transformer to step-down voltage
LAP 13 Determine how a diode is connected to act as a half-wave rectifier
LAP 14 Determine how four diodes are connected to act as a full-wave rectifier
LAP 15 Investigate the charging and discharging of a capacitor
LAP 16 Investigate the effects of connecting capacitors in series and in parallel
LAP 17 Demonstrate how a fixed and variable voltage divider works
LAP 18 Demonstrate how a zener diode regulates voltage
LAP 19 Examine how a bleeder resistor functions
LAP 20 Examine how a dual-polarity power supply functions
LAP 21 Assemble a circuit to test transistors
LAP 22 Test transistors to determine if they are good or bad, and whether they are an NPN or PNP type
LAP 23 Demonstrate the operation of a photocell

38
LAP 24 Assemble a sensitive light meter using a single transistor for amplification
LAP 25 Assemble a basic two transistor audio amplifier
LAP 26 Demonstrate how an amplifier, with feedback, becomes an oscillator
LAP 27 Assemble a basic code practice oscillator
LAP 28 Convert the basic oscillator into an electronic metronome
LAP 29 Assemble an oscillator to produce a sound
LAP 30 Demonstrate how to vary a sound
LAP 31 Demonstrate the operation of an AND logic gate
LAP 32 Demonstrate the operation of a NAND logic gate
LAP 33 Demonstrate the operation of an OR logic gate
LAP 34 Demonstrate the operation of an NOR logic gate
LAP 35 Assemble an astable multivibrator using a 555 IC
LAP 36 Assemble a monostable multivibrator using a 555 IC
LAP 37 Demonstrate how a 7490 IC counts incoming pulses and supplies a running total in binary
LAP 38 Demonstrate how to connect a clock pulse to the IC so that it counts automatically
LAP 39 Assemble an LED sequence generator
LAP 40 Assemble a digital counting circuit
LAP 41 Build seven different circuits and develop an understanding of their functions
LAP 42 Verify the boolean p14 equation and the truth table of the AND gate.
LAP 42 Demonstrate the use of inter-connection schematics with a Digital Trainer
LAP 43 Demonstrate AND gate as a control element (receiving two inputs at once and produce one output)
LAP 44 Build a pulse train control circuit using the AND gate and verify it

LAP 45 Build a four-input AND gate using three two-input AND gates, and analyze with truth table

LAP 46 Build and test a real four-input alarm system with light and sound indicators

LAP 47 Demonstrate the use of a NAND gate to construct one of the seven logic gates

LAP 48 Build a 0 to 99 second programmable timer

LAP 49 Build and experiment with an RS Flip-flop (two NAND gates, a four bit memory, and debounced switch)

LAP 50 Demonstrate usage of a JK Flip-Flop can work either as a clocked RS Flip-Flop or as a divider

LAP 51 Demonstrate usage of a 74191: four bit, ripple, Up-down presettable IC counter

LAP 52 Build a high-impedance, high-sensitivity DC voltmeter from an ordinary analog multimeter by using an operational amplifier stage

LAP 53 Program a micrometer/robot system

LAP 54 Troubleshoot a micro-mentor system

LAP 55 Operate robot manually with a keypad programmer

LAP 56 Construct from a diagram the programmer board

LAP 57 Construct from a diagram the CPU board

LAP 58 Construct from a the robot relay control board

LAP 59 Demonstrate ability to read the schematic diagram for the micro-mentor system

LAP 60 Demonstrate ability to read schematic diagram of the robot relay control Board

LAP 61 Demonstrate proper usage of the micro-mentor robot control interconnection chart

LAP 62 Demonstrate proper usage of the instruction set for the 8085 micro-mentor microprocessor system to operate the robot
INDUSTRIAL AUTOMATION/ROBOTICS
LIBBEY HIGH SCHOOL
TOLEDO, OHIO

SENIOR COURSE OUTLINE

MONDAY - WEDNESDAY - FRIDAY

1st 9 WEEKS: Electric Motor Controls I
2nd 9 WEEKS: Automated Manufacturing I
3rd 9 WEEKS: Electric Motor Controls II
4th 9 WEEKS: Automated Manufacturing II

TUESDAY - THURSDAY

1ST 9 WEEKS:
- Tech Math 5
- Electronics 5
- Blueprint Reading 5

2nd 9 WEEKS:
- Tech Math 6
- Electronics 6
- Blueprint Reading 6

3rd 9 WEEKS:
- Tech Math 7
- Electronics 7
- Personal Computers

4th 9 WEEKS:
- Tech Math 8
- Electronics 7
- Tech. Report Writing
SENIOR COURSE DESCRIPTION

ELECTRIC MOTOR CONTROLS I
Fundamentals of: AC/DC electricity, AC/DC motors, interpretation of relay logic schematics, wiring of control devices and systems.

AUTOMATED MANUFACTURING I
Maintenance and troubleshooting of electrical, mechanical, and fluid power systems on industrial machines.

ELECTRIC MOTOR CONTROLS II
Fundamentals of programmable controllers, and electronic variable speed AC/DC motor controllers.

AUTOMATED MANUFACTURING II
Programming of robotic workcells, CNC workstation, materials handling devices. Set-up, operation, and testing of process control simulator. Set-up, operation of computer integrated manufacturing system (CIM).

TECH MATH 5
Principles and practices of mathematical problem solving.

TECH MATH 6
Problems in fluid/electrical and mechanical machine systems.

TECH MATH 7
CNC (Computer Numerical Control) applications

TECH MATH 8
S.P.C. (Statistical Process Control) fundamentals
BLUEPRINT READING 5
   Interpretation of mechanical, fluid power, and electrical schematics for industrial machine systems.

BLUEPRINT READING 6
   Fundamentals of geometric dimensioning

USE OF PERSONAL COMPUTERS
   Introduction to work processing for preparation of a resume.

TECHNICAL REPORT WRITING
   Planning and writing of process, analytical, and examination reports

ELECTRONICS LEVEL 5
   Analog Electronics

ELECTRONICS LEVEL 6
   Advanced digital and operational amplifiers.

ELECTRONICS LEVEL 7
   Microprocessors and machine language programming.
## Course Outline

**Libbey Skill Center - Toledo, Ohio**

**Senior - Electric Motor Control - Course Outline**

**Monday - Wednesday - Friday**

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 1</td>
<td>Lesson 1 - Fundamentals of AC/DC Electricity</td>
</tr>
<tr>
<td>1 - 2</td>
<td>Lesson 2 - AC Power Generation and Transmission</td>
</tr>
<tr>
<td>1 - 3</td>
<td>Lesson 3A - Circuits, Coils, and Capacitors</td>
</tr>
<tr>
<td>1 - 4</td>
<td>Lesson 3B - Circuits, Coils, and Capacitors</td>
</tr>
<tr>
<td>1 - 5</td>
<td>Lesson 4 - Three-Phase Power Circuits</td>
</tr>
<tr>
<td>1 - 6</td>
<td>Lesson 5 - Reading Electrical Diagrams</td>
</tr>
<tr>
<td>1 - 7</td>
<td>Lesson 6 - Electrical Troubleshooting Techniques</td>
</tr>
<tr>
<td>1 - 8</td>
<td>Lesson 7 - Review</td>
</tr>
<tr>
<td>1 - 9</td>
<td>Lesson 8 - Nine Weeks Test</td>
</tr>
</tbody>
</table>
FIRST NINE WEEKS ACTIVITIES

1. ELECTRICAL SYMBOLS AND BASIC CONTROL DIAGRAMS
   o Worksheet 2 - 1
   o Worksheet 2 - 2
   o Worksheet 2 - 3
   o Tech - Check 2

2. MODULE A
   o Two Wire Control Circuit
   o Three Wire Control Circuit
   o Multiple Station Control
   o Sequence Control
   o Auxiliary Contact Interlocks
   o Interlocking Methods

3. MODULE B
   o Two Wire Control Circuit
   o Separate Control
   o Three Wire Control
   o Mechanically Held Relays
   o H. O. A. Control

4. MODULE C
   o Two Wire Control
   o Three Wire Control o H. O. A. Control
   o Multiple Station Control
   o Jogging Control
   o Jogging With a Control Relay
   o Jogging Control with A Two-Position Selector Switch

5. MODULE D
   o Two Wire Control Circuit
   o Three Wire Control
   o Multiple Station Control
   o Jogging Control
   o Jogging With a Control Relay
   o Interlocking Method
   o Reversing Circuit
   o Reversing Control With Jogging
6. MODULE E

- Two Wire Control Circuit
- Three Wire Control Circuit
- Multiple Station Control
- Jogging Control
- Drum switch Control Circuit
# INDUSTRIAL AUTOMATION/ROBOTICS

LIBBIEY SKILL CENTER

TOLEDO, OHIO

SENIOR - ELECTRIC MOTOR CONTROL SCHEDULE

MONDAY - WEDNESDAY - FRIDAY

<table>
<thead>
<tr>
<th>HOURS</th>
<th>LESSONS</th>
<th>ACTIVITIES</th>
</tr>
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<tbody>
<tr>
<td>8:00 - 9:00</td>
<td>Dale</td>
<td>Joe N.</td>
</tr>
<tr>
<td></td>
<td>Bill</td>
<td>Steve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joe L.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jim</td>
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<tr>
<td></td>
<td></td>
<td>Clyde</td>
</tr>
<tr>
<td>9:00 - 10:00</td>
<td>Joe N.</td>
<td>Joe L.</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>Dale</td>
</tr>
<tr>
<td></td>
<td>Clyde</td>
<td>Bill</td>
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<tr>
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<td>Angel</td>
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<tr>
<td></td>
<td></td>
<td>Jim</td>
</tr>
<tr>
<td>10:00 - 11:00</td>
<td>Joe L</td>
<td>Angel</td>
</tr>
<tr>
<td></td>
<td>Jim</td>
<td>Joe N</td>
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<td>Steve</td>
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<td></td>
<td></td>
<td>Clyde</td>
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<tr>
<td>11:00 - 12:00</td>
<td>Angel</td>
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# Electric Motor Control
## Activities Rotation

<table>
<thead>
<tr>
<th>Students</th>
<th>Three Days Per Station</th>
</tr>
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<tbody>
<tr>
<td><strong>Name</strong></td>
<td>A</td>
</tr>
<tr>
<td>8:00 - 9:00</td>
<td></td>
</tr>
<tr>
<td>Joe N.</td>
<td>1</td>
</tr>
<tr>
<td>Steve</td>
<td>5</td>
</tr>
<tr>
<td>Joe L.</td>
<td>4</td>
</tr>
<tr>
<td>Jim</td>
<td>3</td>
</tr>
<tr>
<td>Clyde</td>
<td>2</td>
</tr>
<tr>
<td>9:00 - 10:00</td>
<td></td>
</tr>
<tr>
<td>Joe L.</td>
<td>4</td>
</tr>
<tr>
<td>Dale</td>
<td>1</td>
</tr>
<tr>
<td>Bill</td>
<td>5</td>
</tr>
<tr>
<td>Jim</td>
<td>3</td>
</tr>
<tr>
<td>Angel</td>
<td>2</td>
</tr>
<tr>
<td>10:00 - 11:00</td>
<td></td>
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<tr>
<td>Joe N.</td>
<td>1</td>
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<tr>
<td>Steve</td>
<td>5</td>
</tr>
<tr>
<td>Clyde</td>
<td>2</td>
</tr>
<tr>
<td>Angel</td>
<td>4</td>
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</tbody>
</table>
STAFF INFORMATION
JOB DESCRIPTION CURRICULUM COORDINATOR

THIS PERSON WILL WORK FULL TIME IN THE LIBBEY INDUSTRIAL AUTOMATION PROGRAM IN CONJUNCTION WITH THE INSTRUCTOR AND LAB ASSISTANT TO DEVELOP COMPETENCY BASED INSTRUCTIONAL MATERIALS.

QUALIFICATIONS:

- Experience and knowledge in private/public sector initiatives.
- Experience and knowledge in educational instructional methodology, for both adults and secondary students.
- Experience in budget management of external funding between public/private sectors.
- Experienced public sector instructor/counselor.
- Experience in replicating instructional programs.
- Experience in recordkeeping and systems accountability.
- Experience in administering standardized test instruments.
- Accredited learning in the principles and practices of hydraulic systems and components.
JOB DESCRIPTION FOR LAB ASSISTANT

THIS PERSON SHOULD HAVE HAD A MINIMUM OF FIVE YEARS WORKING IN AN INDUSTRIAL SETTING AS AN INDUSTRIAL AUTOMATION MAIN TENANCE MECHANIC. THIS PERSON WILL WORK DIRECTLY WITH THE INDUSTRIAL AUTOMATION INSTRUCTOR.

- Working knowledge of fluid power systems and components
- Working knowledge of hand and power tools
- Working knowledge of machine shop equipment
- Working knowledge of power transmission devices
- Working knowledge of basic machine repair
- Working knowledge of electronic control devices
- Willingness to prepare and repair mechanical devices to be utilized in the instructional program
- Demonstrate ability to work independently without direct supervision
- Demonstrate ability to interact with students in positive ways
Jerry Ewig
2733 Barrington
Toledo, Ohio 43606
Telephone: (419) 531-4189 (Residence)
(419) 385-9415 (School)

Areas of Knowledge and Experience:

Industrial Maintenance Mechanic
Tool and Die Machinist
Hydraulics Specialist
Welding Fabricator

Education:

43 semester hours in Mechanical Engineering, University of Toledo
B.S. Industrial Education, Bowling Green State University, 1970
M.A. Philosophical Studies, Wittenberg University, 1967
B.A. Political Science, Carthage College, 1963

Specialized Training From Industrial Schools:
Non-Servo Robotics Maintenance Amatrol Corporation, 1986
Servo Robotics Maintenance Amatrol Corporation, 1986
Weatherhead Hydraulics Fittings School, Dana Technical Center, 1986
Auto-CAD Workshop, Owens Technical College, 1986
Vickers Industrial Hydraulics School, Vickers Corporation, 1985
SLC100 Programmable Controller Workshop, Allen Bradley Corporation, 1985
High Tech CNC Applications Lawrence Institute of Technology, 1985
Optical Scanner Workshop Redline Corporation, 1984
Boston Gear Speed Reducer School, Ohio Belting and Transmission Company, 1984
American Foundryman's Society Training Institute, 1974
Hobart School of Welding, 1974
Dow Chemical Welding School, 1973
Metrology Workshop - Bowling Green State University, 1973
Outboard Marine Mechanic's School O.M.C. Corp., 1973
Stress Analysis Workshop - Bowling Green State University, 1971

Certification:

Ohio Vocational Education Industrial Maintenance Instructor
Ohio Vocational Education Machine Shop Instructor
Ohio Industrial Education Technology Instructor
Jerry Ewig's Vita (continued)

Experience:

Present - 1976  Industrial Education Instructor, Toledo Public Schools.
   Location: Industrial Automation Maintenance Center - Libbey Skill Center


1970 - 1968  Wacker Tool & Die - Sheet Metal Tooling Machinist


1967 - 1961  Anchor Coupling Corporation Industrial Mechanic

Personal:

Born: July 14, 1941

Married

Health - Excellent
LEONA MAXINE HALL-EWIG
2733 BARRINGTON
TOLEDO, OHIO 43606
(419) 531-4189

EDUCATION

B.S. in Education, 1955, Central State University,
Edmond, Oklahoma.

Additional Graduate Study

Trainee Validation Training, Personal and Human Growth
(three credit hours), University of San Diego, San Diego,
California, Summer 1986.

Personal and Human Growth (six credit hours), University
of San Diego, San Diego, California, Summer 1985.

Personal and Guidance (twenty credit hours), Southwest
Texas State University, San Marcos, Texas, 1973-1975.

Curriculum development in Personal Financial Management
(six credit hours), University of Wisconsin, Madison,
Wisconsin, 1957.

Additional Professional Training

"Introduction to Electronic Controls for Modern Hydraulic
Industry" (40 instructional hours), Rexroth Corporation's
School, Bethlehem, PA Summer of 1986.

"Maintaining Hydraulic Components and Systems (80
instructional hours), Rexroth Corporation's School,
Auburn Hills MI Summer of 1989.

"Industrial Hydraulic Maintenance", (40 instructional:
hours), Mid-West Fluid Power Co., Toledo, OH Fall 1988.

EXPERIENCE

- 1988 Private Educational Consultant, Current clients:
University of Oklahoma, Center for Drug Abuse
Prevention; Midwest Fluid Power Company of
Toledo, OH; New Horizons Learning System, Inc.
of Toledo, OH.

1987 - 1984 Consulting and Liaison, Area Vocational School
in Oklahoma; Kansas Department of Social
Rehabilitation; University of Oklahoma, Center
for Drug Abuse Prevention; Rose State College,
Department of Technical/Occupational Education
Leona Maxine Hall-Ewig's Vita (continued)

1987 – 1982 Executive Director, Child Care Careers, Inc. at Oklahoma State University, Stillwater, Oklahoma. A cooperative program funded by the Department and Human Services, CCC Inc., Oklahoma State University, and Oklahoma State Department of Vocational Education, to develop, publish and coordinate a statewide training system utilizing private sector volunteers, and to market the materials and facilitate system replication in other states.

Responsibilities: Manage the program including external fund raising, contracts, fiscal expenditures, and development of training materials. Interface between the CCC Board of Directors, the funding agency and Oklahoma State University. Plan and conduct training for volunteer trainers. Coordinate and facilitate training across the state, manage an office of professionals and staff. Develop and implement a marketing plan. Serve as board member of related professional organizations.

1982 – 1980 Training Specialist, Child Care Careers, Inc., Oklahoma State University, Stillwater, OK. Refined and implemented a recruitment and trainer support system for a statewide network of volunteer trainers. Planned and conducted adult workshops. Facilitated training and recognition for over 3,000 participants. Planned and implemented a data management system to track participants' ongoing training.

1980 – 1976 Assistant Director, Home Economics University Extension, Oklahoma State University, Stillwater, Oklahoma. Marketed off-campus adult education courses for both public and private sectors. Sought new audiences. Coordinated and planned conferences and specialized training with and for faculty members.

Leona Maxine Hall-Ewig's Vita (continued)

1972 - 1955 Classroom Teacher, Public Schools

STRENGTHS

* Educational Training for traditional and non-traditional audiences
* Facilitating educational programs for adults
* Management of programs
* Commitment to professional endeavors
* Team player
* High energy level
PROFESSIONAL

Goal:
To utilize my present skills related to automated manufacturing in an educational setting.

EDUCATION:
Graduate of Springfield High School June 1976
Specialized Training From Industrial Schools
- installation and adjustment of industrial bearings
- coupling devices
- speed reducers and variable speed drives

EXPERIENCE:
June 1976 to February 1977, Electrician's Helper
February 1, 1977 to present Pilliod of Ohio Cabinet Company. Responsibilities during this twelve years included but were not limited to:
- production and assembly line worker
- set-up and maintenance of wet glue and heat sensitive laminators
- offset roll and silk screen printers
- automatic lacquer finishing lines
- adjustment and interfacing of electronic controls with mechanical and fluid power (pneumatic and hydraulic) transmission devices
- troubleshooting of many automated systems
- installed production machinery locally and in other Pilliod plants
- provided special services on sample and customer accounts

STATISTICS: Birthday June 2, 1958
Single Male
Health Excellent

CHARACTERISTICS: Responsible
Accept challenges
Willing worker
A student
INDUSTRIAL AUTOMATION LAB

FLOOR PLAN
BASIC EQUIPMENT LIST

ELECTRONICS LAB - 14 STATIONS
* ANALOG & DIGITAL TRAINERS
* INSTRUMENTATION

COMPUTER/RESOURCE LAB - 5 COMPUTERS
4 VCR's

POWER LAB - MECHANICAL (6 WORKSTATIONS)
* BEARING
* BELTS/CHAINS
* CLUTCHES/BRAKES
* COUPLING ALIGNMENT
* FASTENERS
* GEARS/SPEED REDUCERS

- FLUID - HYDRAULIC (9 WORKSTATIONS)
* CIRCUIT TRAINERS
* PUMP TEST STAND
* PUMP WORK STATION
* VALVE TEST STAND
* VALVE WORK STATION
* HOSE ASSEMBLY STATION
* TUBE LINE FABRICATION STATION

- PNEUMATIC (3 WORKSTATIONS)
* VALVE WORK STATION
* ACTUATOR WORK STATION
* CIRCUIT TRAINER
BASIC EQUIPMENT LIST - 2

SHOP - METAL FABRICATION

* SHIELDED METAL ARC WELDING MACHINES (3)
* MIG MACHINES (3)
* TIG MACHINE
* OXY-ACETYLENE STATIONS (2)
* SHEET METAL BRAKES/BENDERS/NOTCHERS

- MACHINING

* 6 LATHES
* 2 MILLS (VERTICAL, HORIZONTAL)
* 1 SURFACE GRINDER
* 2 BANDSAWS (VERTICAL, HORIZONTAL)
* 1 DRILL PRESS

AUTOMATED MANUFACTURING LAB

INDUSTRIAL MACHINES**

* INJECTION MOLDING**
* PUNCHING**
* THREAD ROLLING**
* INDEXING**
* ROBOTIC WORKCELLS (3)
* CIM SYSTEM

** DONATED BY LOCAL INDUSTRY

MOTOR CONTROL LAB

* WIRING STATIONS (12)
* AC/DC VARIABLE SPEED DRIVES
* PROGRAMMABLE CONTROLLERS (9)
EVALUATION REPORT FOR INDUSTRIAL AUTOMATION MAINTENANCE PROJECT

Libbey High School
Toledo, Ohio

Evaluator
Joyce M. Leimbach
The Ohio State University
PROJECT: INDUSTRIAL AUTOMATION MAINTENANCE PROGRAM

PROJECT EVALUATOR: JOYCE M. LEIMBACH
The Ohio State University
Instructional Materials Laboratory

QUALIFICATIONS:

- Ten years experience as Curriculum Consultant at the Ohio State University, College of Education; previously taught twelve years in secondary vocational classroom.

- Works closely with the Ohio Department of Education, Division of Vocational and Career Education.

- Developed numerous curriculum documents for the State of Ohio

  Auto Mechanics Lab Management Guide
  Carpentry Lab Management Guide
  Electronics Lab Management Guide
  Electricity Lab Management Guide
  Building Maintenance Lab Management Guide
  Welding Lab Management Guide
  Graphic Arts Lab Management Guide
  Nurse Assistant Curriculum Guide
  Curriculum Guide for Licensed Practical Nurses
  Series of student materials for Ohio’s Occupational Work Experience Programs
  Numerous publications for public safety services

- Co-author National VICA Professional Development Program for all Vocational education students

- Primary author National VICA Professional development Program for Automotive Technicians

- Authored numerous other publications for National VICA

- Currently involved in curriculum development for Ohio’s Future At Work; the plan to accelerate vocational education in Ohio

- Serves as Ohio’s state representative to the National Network for Curriculum Coordination in Vocational and Technical Education
The object of the initial visit to Libbey High School in Toledo was to become familiar with the Industrial Automation Maintenance Project, and to become acquainted with the curriculum consultant and the program instructor. The Project Director, John Burkhart, had contacted me to evaluate the project at a professional conference early in 1989. At the initial visit, the director, curriculum consultant, and instructor reviewed the program objectives, established dates for on-site reviews, and discussed the proposed progression of activities to the closure of the project.

In addition, a tour was taken of the facilities to learn about the equipment components, the tools and materials acquired, the individual learning stations, and to ascertain an overview of the laboratory management system. The process of the curriculum research and literature review was explained by the consultant. She had gathered numerous documents, samples of video presentations, etc. to review for their applicability to the proposed curriculum for cross-training. This was done in a very comprehensive manner.

The course outline was reviewed along with realistic timeliness for the in-depth development process. It was obvious all three participants were knowledgeable of what was needed to meet the objectives. A concern was expressed for the timeline regarding completion of the two-year curriculum package.

The initial visit was followed by a second on-site visit in April 1990. To actually review the individual learning activity packet (LAP) content as proposed and discuss exactly where the consultant was with regard to the junior-year curriculum. The organization of the physical facilities in the learning laboratory was exemplary. At this point I expressed a concern that the LAPs for the junior year would be completed.

After the second visit I met with the Project Director and expressed my concerns. I was in constant phone contact with Mr. Burkhart, and we also frequently attended the same professional conferences.

In July 1990 I revisited the program and a significant gain was noticeable with regard to continued development of the individual LAPs and strategies had been identified for implementation of the program. At this point 80% of the milling LAPs, 50% of the power transmission LAPs, 75% of the welding LAPs, and 50% of the fluid power LAPs were completed. We discussed the rationale for the program and how the program fits into Ohio's plan to accelerate the modernization for vocational education.
We also discussed implementation strategies that would help future vocational administrators implement the program. The consultant and instructor both expressed concern for developing a fair evaluation program for the individual student. As Ohio’s representative to the National Curriculum Network I was able to provide sample evaluation instruments and rating sheets from other states.

A follow-up phone conference was held with the Project Director to share observations.

In August 1990 I revisited the program and was pleasantly surprised to find most of the materials in place. A word processing operator was assisting with completion of the final document. Again, the laboratory was in exemplary condition as it was being prepared for the coming school year.

In September 1990 I made a final visit to the program to review the final content of the project as it was drawing to closure. At this meeting I suggested the following items to be included in the final document: a generic equipment list with estimated costs, an estimated timeframe for program setup and implementation, a complete task list for the two-year curriculum, a list of all resources (with sources listed), a list of job titles for graduates; implementation and management strategies, a student profile for the average student in the program, and a narrative of the importance of the management of the systems approach used in the program at Libbey High School.

Approximately 33 LPAS have been completed in the following areas: power and fluid transmission, machining, and fabrication, with additional materials for electronics.

To summarize the monitoring evaluation, I conclude the amount of materials developed for the project in the timeframe allowed, is extensive. It is my opinion that Maxine Hall, the project consultant and Jerry Ewig, the program instructor have drawn the project to closure in a comprehensive manner. At the exit on-site visit a tour of the facilities presented a learning laboratory that is outstanding for student learning.

At the September visit I observed students entering the program facilities with a positive attitude ready to proceed with learning. They greeted the instructor and proceeded to take charge of their assignments. Mr. Ewig commented that he noted an awareness of change in teaching/learning styles, i.e. transferring from the traditional structure of classroom lecture/demonstration to the use of individual learning activity packets, was critical to the success of the program. Students slowly evolve into a self-responsibility mode and take charge of their own learning activities. This concept is different for most instructors in Ohio’s educational facilities.
SUGGESTIONS FOR REPLICATING THE INDUSTRIAL AUTOMATION MAINTENANCE PROGRAM

The pilot project of the Industrial Maintenance Program at Libbey High School in Toledo, Ohio addresses some major changes and challenges as presented in Ohio's action plan for accelerating vocational education (8/90). It presents opportunities for graduates to learn competencies that broaden the scope of vision in maintaining and operating industrial equipment and meet the changing demands in the industrial arena. It is likely the program would be most successful in a school setting where administrators and counselors became involved with promotion of the program and the pool of students eligible to enroll included a majority of better-than-average ability. The highly-motivated student with a concern for his or her future will benefit the most from this type of cross-training.

The curriculum provides an opportunity for displaced workers or workers in need of upgrading and retraining, to return to the learning laboratory for continued lifelong learning to maintain pace with the changing workplace. It allows for graduates to become knowledgeable in several occupational areas. Core competencies are critical to student job success; however, many occupationally-transferable skills enrich the total curriculum.

The program will be most successful and productive in facilities that have been newly-planned and constructed; however, as vocational programs are phased out (lack of enrollment, lack of resources, etc.), an existing learning laboratory can be remodeled and/or modified to fit the need.

Since the majority of the related-theory learning is via individual LAPS it is very important that the area set aside to house the learning carols, audio visuals, and materials be somewhat soundproof to provide an uninterrupted learning environment. If only one instructor is employed it is recommended that a glass viewing window be installed between the theory room and the learning laboratory with the major equipment to diminish the noise and provide a clean classroom setting.

It is suggested that a lab assistant be provided in the learning laboratory with one instructor teaching the total curriculum. Due to the wide variety of tasks addressed in the program and the logistics of the learning laboratory layout, an assistant is a valuable asset to ensure the safety of the students, reduce liability for the school, and enhance learning. An assistant would be especially helpful in a program with open entry/exit. The ideal assistant would be a recent graduate who may be furthering his or her education, and have a need for extra resources and a flexible time schedule. The assistant must be proficient in the core competencies.
APPENDIX II
FLUID POWER

TUBE LINE FABRICATION

PNEUMATICS

HYDRAULIC PUMPS

HYDRAULIC VALVES

ACTUATORS

HYDRAULIC CIRCUITS

MECHANICAL POWER

BEARINGS

CLUTCHES AND BRAKES

COUPLINGS

FASTENERS

GEARS

V-BELTS AND CHAINS
1. The reservoir may be drawn as many times as convenience dictates.

2. A line which terminates below the fluid level is drawn to the bottom of the symbol.
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  FLUID POWER
INSTRUCTIONAL UNIT  FLUID POWER
LAP TITLE  SAFETY AND TOOL IDENTIFICATION

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to pass a safety test with 100% accuracy and identify tools and their locations. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Pass Safety Test with 100% accuracy and identify tools and their locations

REFERENCES  ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

<table>
<thead>
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<th>Prerequisites</th>
<th>Time Range</th>
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<tbody>
<tr>
<td>FP-0</td>
<td>None</td>
<td>2 Hours</td>
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FLUID POWER

TUBE LINE FABRICATION

LAP # 1
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          FLUID POWER

INSTRUCTIONAL UNIT                  TUBE LINE FABRICATION

LAP TITLE                          LAYOUT

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely layout and bend tubing to specifications. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Layout and bend tubing to specifications

REFERENCES

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<th>Prerequisites</th>
<th>Time Range</th>
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<tbody>
<tr>
<td>FP-TLF #</td>
<td>FP-0</td>
<td>3 Hours</td>
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</table>

73
FLUID POWER

TUBE LINE FABRICATION

LAP # 2

74
MAJOR INSTRUCTIONAL AREA: FLUID POWER

INSTRUCTIONAL UNIT: TUBE LINE FABRICATION

LAP TITLE: FITTINGS

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to identify and measure various types of fittings commonly used with tubing. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Identify and measure various types of fittings commonly used with tubing

REFERENCES:

LAP # | Prerequisites | Time Range
--- | --- | ---
FP-TLF # 2 | FP-TLF 1 | 3 Hours
FLUID POWER
TUBE LINE FABRICATION

LAP # 3
76
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
FLUID POWER

INSTRUCTIONAL UNIT
TUBE LINE FABRICATION

LAP TITLE
TUBING

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely cut, flare, and fit tube to fittings. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Cut, flare, and fit tube to fittings

REFERENCES

<table>
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<td>3 Hours</td>
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</table>
FLUID POWER

TUBE LINE FABRICATION

PROPERLY MADE TUBE CIRCUIT

CENTERLINE IF BENT 92°

CENTERLINE IF BENT 88°

ANGLE ERROR MULTIPLIES OVER DISTANCE

LEVEL

PLUMB LINE

FITTING

FITTING

LAP # 4

78
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA        FLUID POWER

INSTRUCTIONAL UNIT                TUBE LINE FABRICATION

LAP TITLE                        INSTALL AND TEST TUBING

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely install and test tubing fabrication to pneumatic power supply. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Install and test tubing fabrication to pneumatic power supply

REFERENCES
ARO. *Fluid Power Text*. The ARO Corp. Bryan, OH.

<table>
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<th>Time Range</th>
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<td>FP-TLF # 4</td>
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LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  FLUID POWER

INSTRUCTIONAL UNIT  PNEUMATICS

LAP TITLE  FILTER REGULATOR AND LUBRICATION

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to disassemble, inspect, and assemble filter regulator and lubricator units. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Disassemble, inspect, and assemble filter regulator and lubricator units

REFERENCES  
ARO. *Fluid Power Text*. The ARO Corp. Bryan, OH. 

<table>
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<tr>
<th>LAP #</th>
<th>Prerequisites</th>
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<tr>
<td>FP-PN # 1</td>
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LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER
INSTRUCTIONAL UNIT PNEUMATICS
LAP TITLE DIRECTIONAL CONTROL VALVE

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely disassemble, inspect, and assemble a pneumatic directional control valve. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Disassemble, inspect, and assemble a pneumatic directional control valve

REFERENCES

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<th>Prerequisites</th>
<th>Time Range</th>
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<tr>
<td>FP-PN # 2</td>
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</table>
FLUID POWER

PNEUMATICS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER

INSTRUCTIONAL UNIT PNEUMATICS

LAP TITLE CYLINDERS

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely disassemble, inspect, and assemble a pneumatic cylinder. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Disassemble, inspect, and assemble a pneumatic cylinder

REFERENCES

ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

LAP #: FP-PN # 3
Prerequisites: FP-0, FP-PN 0-2
Time Range: 3 hours
FLUID POWER

PNEUMATICS

86

LAP # 4
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  FLUID POWER

INSTRUCTIONAL UNIT  PNEUMATICS

LAP TITLE  MOTORS

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to safely disassemble, inspect, and assemble a pneumatic motor. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Disassemble, inspect, and assemble a pneumatic motor


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
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FLUID POWER

PNEUMATICS

88
LAP # 5
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
FLUID POWER

INSTRUCTIONAL UNIT
PNEUMATICS

LAP TITLE
HAND TOOLS

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely disassemble, inspect, and assemble a pneumatic hand tool. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Disassemble, inspect, and assemble a pneumatic hand tool

REFERENCES

<table>
<thead>
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<th>LAP #</th>
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<th>Time Range</th>
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FLUID POWER

PNEUMATICS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  FLUID POWER

INSTRUCTIONAL UNIT  PNEUMATICS

LAP TITLE  TROUBLESHOOTING

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to safely assemble, verify, and troubleshoot an air logic system. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Assemble, verify, and troubleshoot an air logic system

REFERENCES  ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

<table>
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<td>FP-PN # 6</td>
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FLUID POWER

HYDRAULIC HOSE ASSEMBLY

LAP # 1
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  FLUID POWER

INSTRUCTIONAL UNIT  HYDRAULIC HOSE ASSEMBLY

LAP TITLE  IDENTIFY AND MEASURE HOSE

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to identify and measure various types of hose ends used in hydraulic systems. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Identify and measure various types of hose ends used in hydraulic systems

REFERENCES

ARCO. *Fluid Power Text*. The ARO Corp. Bryan, OH.

LAP #  FP-HHA # 1

Prerequisites  FP-0

Time Range  3 Hours

93  1
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA: FLUID POWER

INSTRUCTIONAL UNIT: HYDRAULIC HOSE ASSEMBLY

LAP TITLE: IDENTIFY AND MEASURE FITTINGS

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to identify and measure various types of fittings used in hydraulic systems. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Identify and measure various types of fittings used in hydraulic systems

REFERENCES:

LAP # | Prerequisites | Time Range
---|---|---
FP-HHA # 2 | FP-HHA 1 | 3 Hours
FLUID POWER

HYDRAULIC HOSE ASSEMBLY

LAP # 3

96
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER

INSTRUCTIONAL UNIT HYDRAULIC HOSE ASSEMBLY

LAP TITLE HOSE CRIMPING

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely crimp hose ends and fittings on hydraulic hose. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Crimp hose ends and fittings on hydraulic hose

REFERENCES

LAP # Prerequisites Time Range
FP-HHA # 3 FP-HHA 1 – 2 3 Hours
FLUID POWER

HYDRAULIC HOSE ASSEMBLY

Avoid Twisting

Protect from Hazardous Environment

LAP # 4

98
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  FLUID POWER
INSTRUCTIONAL UNIT  HYDRAULIC HOSE ASSEMBLY
LAP TITLE  INSTALL HOSE ASSEMBLY

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to safely install and test hose assembly on hydraulic power. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Install and test hose assembly on hydraulic power

REFERENCES  
ARO.  Fluid Power Text.  The ARO Corp.  Bryan, OH.  

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
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</thead>
<tbody>
<tr>
<td>FP-HHA # 4</td>
<td>FP-HHA 1 - 3</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
FLUID POWER

HYDRAULIC HOSE ASSEMBLY

Pipe Wrench
Pipe Cutter
Pipe Vise
Cutting Fluid
Pipe Reamer
Pipe Threaders
3-Way
Drop Head Ratchet

LAP # 5
100
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA        FLUID POWER

INSTRUCTIONAL UNIT                HYDRAULIC HOSE ASSEMBLY

LAP TITLE                         PIPE FITTING

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely cut, thread, and fit pipe. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Cut, thread, and fit pipe

REFERENCES


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HHA # 5</td>
<td>FP-HHA 1 - 4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

101
FLUID POWER

HYDRAULIC HOSE ASSEMBLY

LAP # 6

102
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  FLUID POWER
INSTRUCTIONAL UNIT  HYDRAULIC HOSE ASSEMBLY
LAP TITLE  INSTALLING HOSE ASSEMBLY

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to safely install pipe assembly according to schematic. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Install pipe assembly according to schematic

REFERENCES  
ARO. Fluid Power Text. The ARO Corp. Bryan, OH. 

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HHA # 6</td>
<td>FP-HHA 1 - 5</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
FLUID POWER—HYDRAULIC VALVES LAP # 1

LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA 
FLUID POWER

INSTRUCTIONAL UNIT 
HYDRAULIC VALVES

LAP TITLE 
PRESSURE CONTROL VALVES

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely disassemble, inspect, assemble, and test pressure control valves. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Disassemble, inspect, assemble, and test pressure control valves

REFERENCES
ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HV # 1</td>
<td>FP-0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          FLUID POWER

INSTRUCTIONAL UNIT                  HYDRAULIC VALVES

LAP TITLE                           FLOW CONTROL VALVES

PERFORMANCE OBJECTIVE              After completion of this LAP, you should be able to safely disassemble, inspect, assemble, and test flow control valves. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK                                Disassemble, inspect, assemble, and test flow control valves

REFERENCES

LAP #  Prerequisites  Time Range
FP-HV # 2  FP-HV 1   3 Hours
FLUID POWER
HYDRAULIC VALVES

SOLENOID INDICATOR LIGHTS
SOLENOID
MOUNTING PAD FACE
VALVE BODY

LAP # 3
108
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          FLUID POWER

INSTRUCTIONAL UNIT                 HYDRAULIC VALVES

LAP TITLE                           DIRECTIONAL CONTROL VALVES

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely disassemble, inspect, assemble, and test directional control valves. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK                      Disassemble, inspect, assemble, and test directional control valves

REFERENCES

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HV # 3</td>
<td>FP-HV 1 - 2</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
**FLUID POWER**

**HYDRAULIC VALVES**

**MODEL CODE BREAKDOWN**

DG 4 V - 3 - **- W (L) - **- 10 - (LH) - (S300)

- **DIRECTIONAL VALVE**
- **SUBPLATE OR MANIFOLD MOUNTED**
- **SOLENOID OPERATED**
- **MAXIMUM PRESSURE RATING**
  - **350 bar RATING (5000 PSI)**
- **NFPA-D01 INTERFACE**
- **SPOOL TYPE**
  - **A - SPRING OFFSET**
  - **B - SPRING CENTERED**
  - **C - SPRING CENTERED**
  - **N - NO SPRING DETENTED**

**OPERATION**

210 bar, (3045 PSI) OPERATION ALL PORTS.

**SINGLE SOLENOID MODELS ONLY. FOR LEFT HAND ASSEMBLY. OMIT FOR RIGHT HAND ASSEMBLY**

- **DESIGN**
  - **-11 DESIGN**
  - **"N" MODELS**

**COIL CODE LETTER**

(SEE TABLE FOR VOLTAGE & FREQUENCY)

**OPTIONS**

- W 1/4 NPT WIRING HOUSING
- WL 1/4 NPT WIRING HOUSING WITH SOLENOID INDICATOR LIGHTS

**NOTE:** (F3) VITON SEALS ARE STANDARD IN THIS UNIT.
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER

INSTRUCTIONAL UNIT HYDRAULIC VALVES

LAP TITLE REPLACEMENT PARTS

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely locate necessary information for ordering replacement parts given a defective hydraulic valve. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Given a defective hydraulic valve, locate necessary information for ordering replacement parts

REFERENCES


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HV # 4</td>
<td>FP-HV 1 - 3</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
FLUID POWER ACTUATORS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER
INSTRUCTIONAL UNIT ACTUATORS
LAP TITLE CYLINDER

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely disassemble, inspect, and reassemble a hydraulic cylinder. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Disassemble, inspect, and reassemble a hydraulic cylinder

REFERENCES
ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

LAP # Prerequisites Time Range
FP-A # 1 FP # 0 3 Hours
FLUID POWER
HYDRAULIC PUMPS

1. Vacuum is created here as teeth unmesh. Oil enters from reservoir.

2. Oil is carried around housing in chambers formed between teeth, housing and side plates...

3. And forced out of pressure port as teeth go back into mesh.

4. Outlet pressure against teeth causes heavy side-loading on shafts as indicated by arrows.

DRIVE GEAR

INLET

OUTLET
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          FLUID POWER

INSTRUCTIONAL UNIT                 HYDRAULIC PUMPS

LAP TITLE                          GEAR PUMPS

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely disassemble, inspect, and reassemble a gear pump. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Disassemble, inspect, and reassemble a gear pump

REFERENCES

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HP # 1</td>
<td>FP-0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
FLUID POWER

INSTRUCTIONAL UNIT
HYDRAULIC PUMPS

LAP TITLE
VANE PUMPS

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely disassemble, inspect, and reassemble a vane pump. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Disassemble, inspect, and reassemble a vane pump

REFERENCES

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HP # 2</td>
<td>FP-HP 0-1</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

117
FLUID POWER
HYDRAULIC PUMPS

Diagram of fluid power hydraulic pumps with labels:
- Piston shoe
- Swash plate
- Spherical washer
- Piston
- Shoe plate
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER

INSTRUCTIONAL UNIT HYDRAULIC PUMPS

LAP TITLE PISTON PUMPS

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely disassemble, inspect, and reassemble a piston pump. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Disassemble, inspect, and reassemble a piston pump

REFERENCES

ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HP # 3</td>
<td>FP-HP 0-2</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
FLUID POWER
HYDRAULIC PUMPS

PUMP CURVE

FLOW-GALLONS PER MINUTE
PRESSURE-POUNDS PER SQUARE INCH

1725 RPM
3450 RPM

120
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER

INSTRUCTIONAL UNIT HYDRAULIC PUMPS

LAP TITLE PUMP TEST

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely test vane pump for mechanical and volumetric efficiency. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Test vane pump for mechanical and volumetric efficiency

REFERENCES
ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

LAP # Prerequisites Time Range
FP-HP # 4 FP-0, FP-HP 0-3 3 Hours
FLUID POWER

HYDRAULIC CIRCUITS

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Diagram showing hydraulic circuit components and flow directions.
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
FLUID POWER—HYDRAULIC CIRCUITS LAP #

LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
FLUID POWER

INSTRUCTIONAL UNIT
HYDRAULIC CIRCUITS

LAP TITLE
LINEAR CIRCUITS

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely demonstrate basic linear hydraulic circuit. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Demonstrate basic linear hydraulic circuit

REFERENCES

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
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</thead>
<tbody>
<tr>
<td>FP-HC # 1</td>
<td>FP-0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
FLUID POWER

INSTRUCTIONAL UNIT
HYDRAULIC CIRCUITS

LAP TITLE
REGENERATIVE CIRCUIT

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely demonstrate regenerative circuit. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Demonstrate regenerative circuit

REFERENCES

LAP #   Prerequisites   Time Range
FP-HC # 2   FP-HC 1   3 Hours
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER

INSTRUCTIONAL UNIT HYDRAULIC CIRCUITS

LAP TITLE SEQUENCING CIRCUIT

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely demonstrate sequencing circuit. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Demonstrate sequencing circuit

REFERENCES
ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

LAP # Prerequisites Time Range
FP-HC # 3 FP-HC 1 - 2 3 Hours
FLUID POWER

HYDRAULIC CIRCUITS

LAP 128

#4
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA   FLUID POWER

INSTRUCTIONAL UNIT   HYDRAULIC CIRCUITS

LAP TITLE   CIRCUIT WITH LIMITED CLamping

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely demonstrate sequencing circuits with limited clamping pressure. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Demonstrate sequencing circuits with limited clamping pressure

REFERENCES

LAP #   Prerequisites   Time Range
FP-HC # 4   FP-HC 1 - 3   3 Hours
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER

INSTRUCTIONAL UNIT HYDRAULIC CIRCUITS

LAP TITLE COUNTER-BALANCE CIRCUIT

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely demonstrate counter-balance circuit. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Demonstrate counter-balance circuit

REFERENCES

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
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</thead>
<tbody>
<tr>
<td>FP-HC # 5</td>
<td>FP-HC 1-4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

131
FLUID POWER

HYDRAULIC CIRCUITS

[Diagram of hydraulic circuit with symbols and labels]

LAP #6

132
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA FLUID POWER

INSTRUCTIONAL UNIT HYDRAULIC CIRCUITS

LAP TITLE SPEED CONTROL

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to safely demonstrate hydraulic circuit with speed control. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Demonstrate hydraulic circuit with speed control

REFERENCES

ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HC # 6</td>
<td>FP-HC 1 - 5</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
FLUID POWER

INSTRUCTIONAL UNIT
HYDRAULIC CIRCUITS

LAP TITLE
TRAVERE AND FEED

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely demonstrate traverse and feed circuit. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Demonstrate traverse and feed circuit

REFERENCES
ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
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<tbody>
<tr>
<td>FP-HC # 7</td>
<td>FP-HC 1 - 6</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
FLUID POWER

HYDRAULIC CIRCUITS

Diagram of hydraulic circuit with various components labeled with numbers.
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA: FLUID POWER

INSTRUCTIONAL UNIT: HYDRAULIC CIRCUITS

LAP TITLE: SPEED CONTROL

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to safely demonstrate sequencing circuit with speed control. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Demonstrate sequencing circuit with speed control

REFERENCES:
- ARO. Fluid Power Text. The ARO Corp. Bryan, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
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<tbody>
<tr>
<td>FP-HC # 8</td>
<td>FP-HC 1 - 7</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

137
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA       FLUID POWER

INSTRUCTIONAL UNIT               HYDRAULIC CIRCUITS

LAP TITLE                       ROTARY MOTION

PERFORMANCE OBJECTIVE           After completion of this LAP, you should be able to safely demonstrate basic hydraulic rotary motion circuit. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK                            Demonstrate basic hydraulic rotary motion circuit


LAP # Prerequisites Time Range
FP-HC # 9 FP-HC 1 - 8 3 Hours
FLUID POWER
HYDRAULIC CIRCUITS

LAP # 10
140
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          FLUID POWER

INSTRUCTIONAL UNIT                  HYDRAULIC CIRCUITS

LAP TITLE                           ROTARY DRIVE

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to safely demonstrate hydraulic rotary drive with speed control. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Demonstrate hydraulic rotary drive with speed control

REFERENCES


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-HC # 10</td>
<td>FP-HC 1 - 9</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
FLUID POWER

HYDRAULIC CIRCUITS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
FLUID POWER

INSTRUCTIONAL UNIT
HYDRAULIC CIRCUITS

LAP TITLE
TROUBLESHOOTING

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to safely troubleshoot a hydraulic circuit. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Troubleshoot a hydraulic circuit

REFERENCES

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
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</thead>
<tbody>
<tr>
<td>FP-HC # 11</td>
<td>FP-HC 1 - 10</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
 BEARINGS

LAP # 1
LEARNING ACTIVITY PACKET

Major Instructional Area: Mechanical Power Transmission
Instructional Unit: Bearings
LAP Title: Identifying and Measuring Bearings

Performance Objective: After completion of this LAP, you should be able to identify the four basic types of bearings and figure the load for a specified bearing. This knowledge will be demonstrated through study sheets, assignment sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK:
Identify type of bearing and figure load

REFERENCES:

LAP # PREREQUISITES TIME RANGE
MPT - B LAP # 1 None 2 Hours
1. GET Video tape "Maintaining Bearings" from cabinet "E", slot # 57 **

2. VIEW Video tape

3. REWIND Video tape and reset counter

4. RETURN Video tape to cabinet "E", slot # 57 **

5. REVIEW Study sheet, pages 3 - 6

6. DO Assignment sheet # 1, pages 7 & 8

7. CHECK Your work, page 9

8. REVIEW Study sheets, pages 10 - 12

9. DO Assignment sheet # 2, page 13

10. REVIEW Study sheet, page 14

11. READ Job sheet

12. GO To shop and enter using SAFETY procedures

13. GET Materials needed

14. DO Job sheet

15. CHECK Your work

16. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

17. RETURN All tools and materials to their proper places

18. CLEAN Your work area

19. RETURN MPT - B LAP # 1 to cabinet

20. GET MPT - B LAP # 2 from cabinet and continue working
BEARINGS

LAP # 2
LEARNING ACTIVITY PACKET

Major Instructional Area  Mechanical Power Transmission
Instructional Unit  Bearings
LAP Title  Bearings, Packings, and Seals

Performance Objective  After completion of this LAP, you should be able to install and remove plain and anti-friction bearings with the Mechanical Arbor Press. This knowledge will be demonstrated through study sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK:
Install and remove plain and anti-friction bearings with the Mechanical Arbor Press

REFERENCES:
1. REVIEW Study sheets
2. READ Job sheet
3. ENTER Shop using SAFETY procedures
4. GET Materials needed
5. DO Job sheet
6. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

7. RETURN Materials to their proper places
8. CLEAN Your work area
9. RETURN MPT - B LAP # 2 to cabinet
10. GET MPT - B LAP # 3 from cabinet and continue
CLUTCHES AND BRAKES
LEARNING ACTIVITY PACKET

Major Instructional Area: Mechanical Power Transmission

Instructional Unit: Clutches/Brakes

LAP Title: Positive Engagement Clutches

Performance Objective: After completion of this LAP, you should be able to identify, disassemble, and assemble one-way positive engagement clutches. This knowledge will be demonstrated through study sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK:
Demonstrate identification, assembly, and disassembly of one-way positive engagement clutches

REFERENCES:

<table>
<thead>
<tr>
<th>LAP #</th>
<th>PREREQUISITES</th>
<th>TIME RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPT-C/B LAP # 1</td>
<td>None</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET      Video tape from cabinet "E", slot 64 **
2. VIEW     Video tape
3. REWIND   Video tape and reset counter
4. RETURN   Video tape to cabinet
5. REVIEW   Study sheets
6. READ     Job sheet
7. GO       To shop using SAFETY procedures
8. GET      Materials need
9. DO       Job sheet, FOLLOWING STEPS CAREFULLY
10. SIGNAL  Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF
YOU NEED TO CONTINUE WITH THIS LAP

11. RETURN  Materials to their proper places
12. CLEAN   Your work area
13. RETURN  MPT - C/B LAP # 1 to cabinet
14. GET     MPT - C/B LAP # 2 from cabinet and continue
MECHANICAL POWER

CLUTCHES AND BRAKES

LAP # 2
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEE SKILL CENTER, TOLEDO, OHIO
MECHANICAL POWER C/B LAP # 2

LEARNING ACTIVITY PACKET

Major Instructional Area: Mechanical Power Transmission
Instructional Unit: Clutches/Brakes
LAP Title: Friction Clutches and Brakes
Performance Objective: After completion of this LAP, you should be able to disassemble, sketch, measure, and reassemble clutch and brake assembly. This knowledge will be demonstrated through study sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK:
Disassemble, sketch, measure, and reassemble clutch and brake assembly

REFERENCES:

LAP #  
MPT-C/B LAP # 2
PREREQUISITES  
MPT-C/B LAP # 1
TIME RANGE  
2 Hours
1. REVIEW Study sheets
2. READ Job sheet
3. ENTER Shop using SAFETY procedures
4. GET Materials need
5. DO Job sheet, FOLLOWING STEPS CAREFULLY
6. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

7. RETURN Materials to their proper places
8. CLEAN Your work area
9. RETURN MPT - C/B LAP # 2 to cabinet
10. GET MPT - C/B LAP # 3 from cabinet and continue
LEARNING ACTIVITY PACKET

Major Instructional Area: Mechanical Power Transmission
Instructional Unit: Fasteners
LAP Title: Measuring Machine Bolts & Screws

Performance Objective: After completion of this LAP, you should be able to identify machine bolts and screws, read a fastener blueprint, measure bolts and screws with: a machinist ruler, dial caliper, and a screw pitch gauge. This knowledge will be demonstrated through study sheets, assignment sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Demonstrate the ability to identify and measure machine bolts and screws

REFERENCES:

LAP #  PREREQUISITES  TIME RANGE
MPT-F LAP # 1  None  3 Hours
1. REVIEW
   Study sheets, pages 2 & 3

2. COMPLETE
   Assignment sheet # 1

3. CHECK
   Your answers— if you missed one, review the study sheet again and correct your answer

4. REVIEW
   Study sheets, pages 5 - 7

5. COMPLETE
   Study sheet # 2

6. READ
   Job sheet—you should understand what you are to do before entering the shop

7. ENTER
   Shop using SAFETY procedures

8. GET
   Equipment and materials required

9. GO
   To the "Fastener" workbench in the MPT area of the shop

10. DO
    Job sheet

11. SIGNAL
    Your INSPECTOR to check your completed work

   YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

12. RETURN
    All tools to their proper place

13. CLEAN
    Your work area

14. RETURN
    The MPT-F LAP # 1 to the cabinet

15. GET
    MPT-F LAP # 2 from the cabinet and continue working
MECHANICAL POWER

FASTENERS

LAP # 2
LEARNING ACTIVITY PACKET

Major Instructional Area Mechanical Power Transmission

Instructional Unit Fasteners

LAP Title Internal and External Tapping

Performance Objective After completion of this LAP, you should be able to perform a layout from a blueprint and perform the specified work of tapping internal and external threads. This knowledge will be demonstrated through study sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS:

- Perform a layout from a blueprint
- Perform drilling operation to layout specification
- Tap external and internal threads
- Repair damaged threads
- Remove a broken bolt/screw

REFERENCES:


<table>
<thead>
<tr>
<th>LAP #</th>
<th>PREREQUISITES</th>
<th>TIME RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPT-F LAP # 2</td>
<td>MPT-F LAP # 1</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW  
   Study sheets

2. COMPLETE  
   Assignment sheet # 1

3. CHECK  
   Your answers—if you missed one, go back and review the study sheet again before correcting your answer

4. READ  
   Job sheet very carefully—if there is something you do not understand, go back and find the answer in the study sheets.

5. ENTER  
   Shop using SAFETY procedures

6. GET  
   Materials and tools needed

7. GO  
   To the "Fastener" workbench in the Mechanical Power Transmission area of the shop

8. DO  
   Job sheet

9. SIGNAL  
   Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. RETURN  
    All tools to their proper place

11. CLEAN  
    Your work area

12. GET  
    Initial stamps and a ball peen hammer

13. STAMP  
    Your initials on the back of your workpiece

14. RETURN  
    Your initial stamps and ball peen hammer

15. RETURN  
    MPT-F LAP # 2 to the cabinet

16. GET  
    MPT-F LAP # 3 from the cabinet and continue working
MECHANICAL POWER

FASTENERS

LAP # 3
LEARNING ACTIVITY PACKET

Major Instructional Area: Mechanical Power Transmission
Instructional Unit: Fasteners
LAP Title: Assembling with Fasteners

Performance Objective: After completion of this LAP, you should be able to: identify types of screw heads, washers, wrenches, match bolt/screw head to correct size of wrench and understand how to figure and apply torque. This knowledge will be demonstrated through study sheets, assignment sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS: Assemble and disassemble component parts requiring torque

REFERENCES:


LAP # | PREREQUISITES | TIME RANGE
--- | --- | ---
MPT-F LAP # 3 | MPT-F LAPs 1 & 2 | 3 Hours
LEARNING ACTIVITY PACKET GUIDE
MECHANICAL POWER TRANSMISSION
FASTENERS - LAP # 3
ASSEMBLING WITH FASTENERS

1. REVIEW Study sheets, pages 3 - 5
2. COMPLETE Assignment sheet # 1
3. CHECK Your answers—if you missed one, review the study sheet again and correct your answers
4. REVIEW Study sheets, pages 9 - 14
5. COMPLETE Assignment sheet # 2
6. CHECK Your answers—if you missed one, review the study sheet again and correct your answers
7. READ Job sheet—you should understand what you are to do before entering the shop
8. ENTER Shop using SAFETY procedures
9. GET Materials and tools needed
10. GO To the "Fastener" workbench in the MPT area of the shop
11. DO Job sheet
12. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

13. RETURN All tools to their proper place
14. CLEAN Your work area
15. GET Initial stamps and a ball peen hammer
16. STAMP Your initials on the back of your workpiece
17. RETURN Initial stamps and ball peen hammer
18. RETURN MPT-F LAP # 3 to the cabinet
19. GET MPT-F LAP # 4 from the cabinet and continue working
GEARS

- Bore
- Rim
- Hub
- Pitch Circle
- Clearance
- Addendum
- Whole Depth
- Dedendum
- Working Depth
- Root Thickness
- Tooth Thickness

LAP # 1
LEARNING ACTIVITY PACKET

Major Instructional Area Mechanical Power Transmission
Instructional Unit Gears
LAP Title Identify and Measurement

Performance Objective After completion of this LAP, you should be able to identify, measure, and size major types of gears utilizing manufacturers specifications. This knowledge will be demonstrated through study sheets, assignment sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Identify, measure, and size major types of gears utilizing manufacturers specifications.

REFERENCES:

LAP # MPT G LAP # 1
PREREQUISITES None
TIME RANGE 3 Hours
1. GET Video tape "Gearing" from cabinet "E", slot # 58 *
2. VIEW Video Tape
3. REWIND Video Tape
4. RETURN Video Tape to cabinet "E" slot # 58 **
5. ENTER Shop practicing SAFETY procedures, you will need pencil and paper,
6. GO To GEARs workbench in the Mechanical Power Transmission area
7. REVIEW Study Sheets pages 3 - 5
8. DO & CHECK Assignment sheet # 1 pages 6 - 7
9. REVIEW Study Sheets pages 8 - 9
11. Do & CHECK Assignment sheet # 2, page 10 - 12
12. REVIEW Study Sheet pages 13 - 14
13. DO & CHECK Assignment sheet, page 15
14. READ JOB sheet
15. DO JOB SHEET
16. Signal Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

17. RETURN All tools and materials to their proper places
18. CLEAN Your work area
19. RETURN MPT-B # 1 to cabinet
20. GET MPT - B # 2 from cabinet and continue working
MECHANICAL POWER

GEARS

COMPPOUND GEAR TRAIN

LAP # 2
LEARNING ACTIVITY PACKET

Major Instructional Area               Mechanical Power Transmission
Instructional Unit                        Gears
LAP Title                                  Compound Gear Train

Performance Objective After completion of this LAP, you should be able to disassemble, calculate ratios, and reassemble a compound gear train. This knowledge will be demonstrated through study sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK:

Demonstrate disassembly, ratio calculations, and reassembly of a compound gear train

REFERENCES:


<table>
<thead>
<tr>
<th>LAP #</th>
<th>PREREQUISITES</th>
<th>TIME RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPT-G LAP # 2</td>
<td>MPT-G LAP # 1</td>
<td>2 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW  Study sheets
2. READ  Job sheet
3. ENTER  Shop using SAFETY procedures
4. GET  Materials needed
5. DO  Job sheet
6. SIGNAL  Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

7. RETURN  Materials to their proper places
8. CLEAN  Your work area
9. RETURN  MPT - G LAP # 2 to the cabinet
10. GET  MPT -G LAP # 3 from the cabinet and continue
V-BELTS AND CHAINS

LAP # 1
LEARNING ACTIVITY PACKET

Major Instructional Area: Mechanical Power Transmission
Instructional Unit: V-Belts and Chains
LAP Title: Identification & Measurement

Performance Objective: After completion of this LAP, you should be able to identify type, determine chain/sprocket number, and calculate speed ratio. This knowledge will be demonstrated through study sheets, assignment sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK:
Identify type, determine chain/sprocket number, and calculate speed ratio

REFERENCES:

<table>
<thead>
<tr>
<th>LAP #</th>
<th>PREREQUISITES</th>
<th>TIME RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPT VB/C LAP # 1</td>
<td></td>
<td>2 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Roller Chain" from cabinet "E", slot # 62 **
2. VIEW Video tape
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet "E", slot # 62 **
5. REVIEW Study sheet
6. DO Assignment sheet
7. CHECK Your answers to make sure they are correct
8. REVIEW Study sheet
9. DO Assignment sheet
10. CHECK Your answers to make sure they are correct
11. REVIEW Study sheet
12. READ Job sheet
13. ENTER Shop using SAFETY procedures
14. GET Materials needed
15. GO To V-Belt/Chain workbench
16. DO Job sheet
17. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON THIS LAP

18. RETURN Materials to their proper places
19. CLEAN Your work area
20. RETURN MPT-V.B & C LAP # 1 to cabinet
21. GET MPT-V.B & C LAP # 2 from cabinet and continue
V-BELTS AND CHAINS

Type III, shallow bath

Type III, disc or slinger

Type IV, oil stream

LAP # 2
LEARNING ACTIVITY PACKET

Major Instructional Area   Mechanical Power Transmission
Instructional Unit         V-Belts and Chains
LAP Title                  Inspection & Installation

Performance Objective      After completion of this LAP, you should be able to disassemble, inspect, and reassemble chain/sprocket assembly. This knowledge will be demonstrated through study sheets, assignment sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK:

Disassemble, inspect, and reassemble chain/sprocket assembly

REFERENCES:

LAP #    PREREQUISITES    TIME RANGE
MPT-VB & C LAP # 2    MPT-VB & C LAP # 1    3 Hours

175
1. REVIEW Study sheet
2. DO Assignment sheet
3. CHECK Your answers to make sure they are correct
4. REVIEW Study sheet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All materials to their proper places
11. CLEAN Your work area
12. RETURN MPT-V.B/C LAP # 2 to the cabinet
13. GET MPT-V.B/C LAP # 3 from the cabinet and continue
MACHINING LEARNING ACTIVITY PACKETS
MACHINING

BENCH METALS

LATHE
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Bench Metals
LAP Title: Steel ruler

Performance Objective: After completion of this LAP, you should be able to demonstrate the ability to use a steel ruler to measure linear and circular objects. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Demonstrate the ability to use a steel ruler in graduations up to 1/32", (utilizing a linear and circular measurement kit) within a tolerance of + \(- \frac{1}{32}\)".

Reference
3 - "Reading a Ruler". Video Tape, Bergwall Productions. Garden City, NY.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM # 1</td>
<td>Bench Metals LAP # 0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
BENCH METALS
LAP # 1

1. GET Video tape "Reading a Ruler, Customary system" located in cabinet "E", slot # 1*
2. VIEW Video tape
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet "E", slot # 1 :
5. REVIEW Study sheet showing eighths and sixteenths graduated ruler, following directions on the sheets as you compare the two
6. COMPLETE Assignment sheet
7. CHECK Your answers using the key on the assignment sheet
8. READ Job sheet, identify equipment needed and procedures
9. GET Video tape "Steel Rulers" located in cabinet "A", slot # 38*
10. VIEW Video tape
11. REWIND Video tape and reset counter
12. RETURN Video tape to cabinet "A", slot # 38 **
13. ENTER Shop using SAFETY procedures
14. GET Materials needed
15. TAKE Your equipment to one of the blue workbenches with a vise
16. DO Job sheet
17. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

18. RETURN Materials to their proper places
19. CHECK To be sure your work area is clean
20. GET Bench Metal LAP # 2
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Bench Metals
LAP Title: Hook Ruler

Performance Objective: After completion of this LAP, you should be able to demonstrate your ability to use a hook ruler to measure both linear and circular items. This knowledge will be demonstrated through a study sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Demonstrate ability to use a hook ruler to measure linear and circular items within a tolerance of ± 1/32".

Reference

LAP # | Prerequisites | Time Range
--- | --- | ---
BM # 2 | Bench Metals LAPs 0 - 1 | 1 Hour
LEARNING ACTIVITY PACKET GUIDE
BENCH METALS
LAP # 2
HOOK RULER

1. REVIEW
   Study sheet
2. READ
   Job sheet
3. ENTER
   Shop using SAFETY procedures
4. GET
   Materials needed
5. GO
   To blue workbench with vise
6. DO
   Job sheet
7. SIGNAL
   Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO
CONTINUE ON WITH THIS LAP

8. RETURN
   All materials to their proper places
9. CLEAN
   Up your work area
10. GET
    BENCH METALS LAP # 3
BENCH METALS
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Bench Metals
LAP Title: Calipers

Performance Objective: After completion of this LAP, you should be able to demonstrate the ability to use a steel ruler to set calipers and take inside and outside measurements with a caliper. This knowledge will be demonstrated through a study sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task:
Demonstrate the ability to use a steel ruler to set calipers and take inside and outside measurements of designated materials within a tolerance of + - 1/32".

Reference:

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 1/2 # 3</td>
<td>Bench Metals LAPs 0 - 2</td>
<td>1 Hour</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
BENCH METALS
LAP # 3
CALIPERS

1. GET Video tape "Setting Calipers with a Steel Ruler" from cabinet "A", slot # 38 *
2. VIEW Video tape footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet "A", slot # 38 *
5. REVIEW Study sheet
6. READ Job sheet
7. ENTER Shop using SAFETY procedures
8. GET Materials needed
9. GO To Blue workbench
10. DO Job sheet
11. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

12. REMOVE Layout marks with sand paper
13. RETURN Materials to their proper places
14. CLEAN Up your work area
15. GET BENCH METALS LAP # 4
BENCH METALS

FIGURE 1

45°

Locking Screw

90°

Desired Length
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Bench Metals
LAP Title: Combination Square

Performance Objective: After completion of this LAP, you should be able to demonstrate the ability to use a combination square to take measurements and to perform a layout to specifications. This knowledge will be demonstrated through a study sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task:
Demonstrate use of a combination square to take measurement and perform a layout to specifications within a tolerance of + - 1/32".

Reference:

LAP # Prerequisites Time Range
B M # 4 Bench Metals LAPs 0 - 3 3 Hours
LEARNING ACTIVITY PACKET GUIDE
BENCH METALS
LAP # 4
COMBINATION SQUARE

1. GET Video tape "Combination Square" from cabinet "A", slot # 38 **
2. VIEW Video tape
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet "A", slot # 38 **
5. REVIEW Study sheet
6. READ Job sheet
7. ENTER Shop using SAFETY procedures
8. GET Materials needed from storage shelf Tray #7 (front section)
9. GO To a blue workbench with vise
10. DO Job sheet
11. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

12. REMOVE Layout marks with sand paper
13. RETURN All materials to their proper places
14. CLEAN Up your work area
15. GET LAP B M # 5
LEARNING ACTIVITY PACKET

Major Instructional Area          Machine Shop
Instructional Unit               Bench Metals
LAP Title                        Dial Caliper

Performance Objective            After completion of this LAP, you should be able to demonstrate the ability to set and use a dial caliper for outside, depth, and inside measurements. This knowledge will be demonstrated through a study sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Demonstrate the ability to set and use a dial caliper for outside, depth, and inside measurements within a tolerance of ± .010".

1. REVIEW  Study sheet
2. READ  Job sheet
3. ENTER  Shop using SAFETY procedures
4. GET  Materials needed from Trays 1 - 6 located on the storage shelf
5. DO  Job sheet
6. SIGNAL  Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

7. RETURN  Materials to their proper places
8. CLEAN  Up your work area
9. GET  LAP B M # 6
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Bench Metals
LAP Title: Reference Point Layout to Specifications

Performance Objective:
After completion of this LAP, you should be able to demonstrate the ability to create a layout to specifications using safety procedures. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task
Demonstrate the ability to create a precision layout according to given specifications within a tolerance of $\pm \frac{1}{32}$".

Reference
3 - RMI Video Productions, "Basic Layout Procedures", "Hole Location" and "3 Contours & Angles", Kansas City, MO

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
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<tbody>
<tr>
<td>BM # 6</td>
<td>Bench Metals LAPs 0 - 5</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
BENCH METALS
LAP # 6
REFERENCE POINT LAYOUT TO SPECIFICATIONS

1. GET Video tape "Basic Layout Procedures from cabinet "A", slot # 1 *
2. VIEW Video tape
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. GET Video tape "Perform Layout with Combination Square Set" from cabinet "A", slot # 47 **
7. VIEW Video tape footage ___ through ___
8. REWIND Video tape and reset counter
9. RETURN Video tape to cabinet
10. ENTER Shop using SAFETY procedures
11. GET Stock from blue shelving, Tray 7
12. GO To a blue workbench with vise
13. DO Job sheet **NOTE Viewing additional video tapes as indicated on your job sheet
14. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

15. RETURN All materials to their proper places
16. CLEAN Up your work area
17. GET Your initial stamps and a ball peen hammer from tool room
18. STAMP Your initials in the center of the backside
19. RETURN Your initial stamps and ball peen hammer to their proper place
20. KEEP Your reference point layout in your locker to use with LAP B M # 7
21. GET LAP B M # 7

196
BENCH METALS

LAP # 7

197
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
BENCH METALS LAP # 7

LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Bench Metals
LAP Title: Fabricate Metal Layout

Performance Objective: After completion of this LAP, you should be able to demonstrate the ability to safely perform a fabrication utilizing hand tools to specification. This knowledge will be demonstrated through a study sheet, a safety test (100% accuracy required), a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Demonstrate the ability to fabricate the layout completed in LAP # 6 using hand tools and pedestal grinder to within ± 1/32" of specifications.

Reference

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM # 7</td>
<td>Bench Metals LAPs 0 - 6</td>
<td>3 Hours</td>
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</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE  
BENCH METALS  
LAP # 7  
FABRICATE METAL LAYOUT

1. REVIEW  
   Study sheet

2. GET  
   Video tape "Hacksaw to Layout" and "File to Layout" from cabinet "A", slot 47 **

3. VIEW  
   Video tape footage ___ through ___

4. REWIND  
   Video tape and reset counter

5. RETURN  
   Video tape to cabinet "A", slot # 47 **

6. TAKE  
   Safety test

7. CHECK  
   Safety test

8. TAKE  
   Safety test answers to your INSTRUCTOR

9. READ  
   Job sheet

10. ENTER  
    Shop using SAFETY procedures

11. GET  
    Materials needed

12. DO  
    Job sheet

13. SIGNAL  
    Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

14. RETURN  
    All materials to their proper places

15. CLEAN  
    Up your work area

16. GET  
    LAP B M # 8
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Bench Metals
LAP Title: Layout Hole Centers

Performance Objective: After completion of this LAP, you should be able to demonstrate the ability to safely perform specified layouts for countersinking, counterboring, and hand tapping operations with a drill press. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task:

Demonstrate the ability to read layout specifications and perform layout techniques for hole conditioning within a tolerance of $+\frac{1}{32}$".

Reference:
LEARNING ACTIVITY PACKET GUIDE
BENCH METALS
LAP # 8
LAYOUT HOLE CENTERS

1. **GET** Video tape "Countersink and Counterbore" from cabinet "A", slot # 50 **

2. **VIEW** Video tape footage ___ through ___

3. **REWIND** Video tape and reset counter

4. **RETURN** Video tape to cabinet "A", slot # 50 **

5. **READ** Job sheet

6. **ENTER** Shop using SAFETY procedures

7. **GET** Materials needed (steel plate Tray # 15)

8. **DO** Job sheet

9. **SIGNAL** Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. **RETURN** All materials to their proper places

11. **CLEAN** Up your work area

12. **GET** Your initial stamps and a ball peen hammer

13. **STAMP** Your initials on the backside of your workpiece

14. **RETURN** Initial stamps and ball peen hammer

15. **GET** LAP B M # 9
BENCH METALS

DRILL 11
CSK .385 x .116 DEEP 2 PLACES

DRILL 5/16
CSK .625 x .170 DEEP

DRILL 5/16
CORE 7/16 x 5/16 DEEP

200
LAP # 9
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
BENCH METALS LAP # 9

LEARNING ACTIVITY PACKET

Major Instructional Area  Machine Shop
Instructional Unit  Bench Metals
LAP Title  Counterboring and Countersinking

Performance Objective  After completion of this LAP, you should be able to demonstrate the ability to safely perform specified countersinking and counterboring operations. This knowledge will be demonstrated through a study sheet, a safety test (100% required), a job sheet and a unit test with a minimum of 85% accuracy.

Tasks

Demonstrate the ability to read layout specifications, perform countersinking, and counterboring operations within a tolerance of + - 1/32".


LAP #  Prerequisites  Time Range
B M 9  Bench Metals LAPs 0 - 8  2 Hours
LEARNING ACTIVITY PACKET GUIDE
BENCH METALS
LAP # 9
COUNTERBORING AND COUNTERSINKING

1. GET Video tape "Countersink and Counterbore" from cabinet "A", slot # 50 **

2. VIEW Video tape

3. REWIND Video tape and reset counter

4. RETURN Video tape to cabinet "A", slot # 50 **

5. REVIEW Study sheets

6. TAKE Safety test

7. READ Job sheet

8. ENTER Shop using SAFETY procedures

9. GET All materials needed (using workpiece from LAP # 8)

10. DO Job sheet

11. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO
CONTINUE ON WITH THIS LAP

12. RETURN All materials to their proper places

13. CLEAN Up your work area

14. GET LAP B M # 10
LEARNING ACTIVITY PACKET

Major Instructional Area  Machine Shop
Instructional Unit  Bench Metals
LAP Title  Tapping Operation

Performance Objective  After completion of this LAP, you should be able to demonstrate the ability to safely perform specified tapping operations. This knowledge will be demonstrated through a study sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Tasks

Demonstrate the ability to read layout specifications and perform a tapping operation within a tolerance of ± 1/32".


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>B M # 10</td>
<td>Bench Metals LAPs 0 - 9</td>
<td>1 Hour</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
BENCH METALS
LAP # 10
TAPPING OPERATION

1. GET Video tape "Tap Holes Using Drill Press" from cabinet "A", slot # ____

2. VIEW Video tape footage ____ through ____

3. REWIND Video tape and reset counter

4. RETURN Video tape to cabinet

5. REVIEW Job sheet

6. ENTER Shop using SAFETY procedures

7. GET Materials needed (using stock from LAPs # 8 & # 9)

8. DO Job sheet

9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO
CONTINUE ON WITH THIS LAP

10. RETURN All materials to their proper places

11. CLEAN Up your work area

12. SEE Your INSTRUCTOR for your next assignment
LEARNING ACTIVITY PACKET

Major Instructional Area  Machine Shop
Instructional Unit  Lathe
LAP Title  SAFETY and Orientation

Performance Objective  After completion of this LAP, you should be able to state safety rules that should be observed, identify lathe parts and accessories, use formulas and charts to calculate speeds and feed, and state proper maintenance procedures when performing lathe work. This knowledge will be demonstrated through study sheets, assignment sheets, a safety test with 100% accuracy, and a unit test with a minimum of 85% accuracy.

Tasks

State safety rules and procedures for using an engine lathe
Identify major parts and accessories of an engine lathe
State rules for care and cleaning of the engine lathe
Use shop formulas and charts to determine lathe speeds, feeds, and depths of cuts

References

4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 0</td>
<td>Orientations Cluster</td>
<td>3 Hours</td>
</tr>
<tr>
<td></td>
<td>Bench Metal Cluster</td>
<td></td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 0
LATHE SAFETY AND ORIENTATION

1. GET
Video tape "Safety on South Bend Lathe" located in cabinet "A", slot # 3

2. VIEW
Video tape

3. REWIND
Video tape and clear counter on VCR

4. RETURN
Video tape to cabinet "A", slot # 3

5. REVIEW
Study sheets, Part 1, pages 3 - 5

6. COMPLETE
Assignment sheet, Part 1, pages 6 - 7

7. CHECK
Assignment sheet with answer sheet

8. REVIEW
Study sheet, Part 2, pages 8 - 14

9. COMPLETE
Assignment sheet 2, page 15 - 16

10. GET
Video tape "Operate Lathe Controls" located in cabinet "A", slot # 53 *

11. VIEW
Video tape footage ___ through ___

12. REWIND
Video tape

13. RETURN
Video tape to cabinet "A", slot # 53 *

14. REVIEW
Study sheets, Part 3 - SAFETY pages 17 - 18

15. TAKE
Test, page 19

16. CHECK
Test with answer sheet

17. SHOW
Your INSTRUCTOR to check your completed SAFETY TEST

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

18. GET
Lathe LAP # 1
LATHE

212
LAP # 1
INDUSTRIAL AUTOMATION MAINTENANCE
MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
LATHE LAP # 1

LEARNING ACTIVITY PACKET

Major Instructional Area  Machine Shop
Instructional Unit  Lathe
LAP Title  Face to Length

Performance Objective  After completion of this LAP, you should be able to safely setup a lathe and face an aluminum stock to specified length. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Tasks

Demonstrate the ability to face an aluminum stock to specified length within + - .001 tolerance

References

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 1</td>
<td>Lathe LAP 0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 1

1. GET Video tape "Perform Facing Operation" from cabinet "A", slot # 53**
2. VIEW Video tape footage ___ through ___
3. REWIND Video tape and clear counter
4. RETURN Video tape to cabinet "A", SLOT # 53 **
5. REVIEW Study sheet.
6. READ Job sheet
7. ENTER Shop using SAFETY procedures
8. GO To a lathe in machine shop area
9. GET Materials and tools
10. DO Job sheet
11. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

12. RETURN All cleaned tools to their proper place
13. CLEAN Your work area and lathe
14. GET Initials stamps and a ball peen hammer
15. STAMP Workpiece
16. RETURN Initials stamps and ball peen hammer
17. GET Lathe LAP # 2
18. PLACE Your workpiece in your locker for use again in LAP # 2
INDUSTRIAL AUTOMATION MAINTENANCE
MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
LATHE LAP # 2

LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Straight Turning

Performance Objective: After completion of this LAP, you should be able to safely perform a straight turning operation on aluminum stock to specifications. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Tasks

Perform a straight turning operation on aluminum stock to specifications ± .001 tolerance

References:

LAP #     Prerequisites     Time Range
Lathe # 2     Lathe LAPs 0 & 1     3 Hours
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 2

1. READ Job sheet
2. ENTER Shop using SAFETY procedures
3. GO To lathe in machine shop area
4. DO Job sheet
5. SIGNAL Your INSPECTOR to check your completed work
   YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO
   CONTINUE ON WITH THIS LAP
6. RETURN All cleaned tools to their proper place
7. CLEAN Your work area and the lathe
8. STORE Your workpiece in your locker
9. GET LAP # 3
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathes
LAP Title: Face steel part to length

Performance Objective: After completion of this LAP, you should be able to safely face a steel part to length. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Tasks

Face a steel part to specified length within + - .001 tolerance

References
4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 3</td>
<td>Lathe LAPs 0 - 2</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Perform Facing Operation" from cabinet "A", slot # 53 **
2. VIEW Video tape footage ___ through ___
3. REWIND Video tape and clear counter
4. RETURN Video tape to cabinet "A", slot # 53 **
5. REVIEW Study sheet
6. READ Job sheet
7. ENTER Shop using SAFETY procedures
8. GET Materials and tools needed from Tray # 18
9. GO To lathe in machine shop area
10. DO Job sheet
11. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

12. RETURN All tools to their proper place
13. CLEAN Your work area and lathe
14. GET Initials stamps and a ball peen hammer
15. STAMP Workpiece
16. RETURN Initials stamps and ball peen hammer
17. PLACE Your workpiece in your locker to use with LAP # 4
18. GET Lathe LAP # 4
LEARNING ACTIVITY PACKET

Major Instructional Area       Machine Shop
Instructional Unit            Lathe
LAP Title                     Straight turning on steel
Performance Objective         After completion of this LAP, you should be able to safely perform a straight turning operation on steel to specifications. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Perform a straight turning operation on steel to specifications within $+ - .010$ tolerance

References

4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP #   Prerequisites   Time Range
Lathe # 4   Lathe LAPs 0 - 3   3 Hours
### LEARNING ACTIVITY PACKET GUIDE

**LATHE**

**LAP #4**

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>GET</strong></td>
<td>Video tape &quot;Perform Straight Turning&quot; from cabinet &quot;A&quot;, slot # 56 **</td>
</tr>
<tr>
<td>2.</td>
<td><strong>VIEW</strong></td>
<td>Video tape from footage ___ through ___</td>
</tr>
<tr>
<td>3.</td>
<td><strong>REWIND</strong></td>
<td>Video tape and clean the VCR</td>
</tr>
<tr>
<td>4.</td>
<td><strong>RETURN</strong></td>
<td>Video tape to cabinet &quot;A&quot;, slot # 56 **</td>
</tr>
<tr>
<td>5.</td>
<td><strong>READ</strong></td>
<td>Job sheet</td>
</tr>
<tr>
<td>6.</td>
<td><strong>ENTER</strong></td>
<td>Shop using SAFETY procedures</td>
</tr>
<tr>
<td>7.</td>
<td><strong>GET</strong></td>
<td>Materials and tools as listed on your job sheet</td>
</tr>
<tr>
<td>8.</td>
<td><strong>GO</strong></td>
<td>To a lathe in Machine Shop Area</td>
</tr>
<tr>
<td>9.</td>
<td><strong>DO</strong></td>
<td>Job sheet</td>
</tr>
<tr>
<td>10.</td>
<td><strong>SIGNAL</strong></td>
<td>Your INSPECTOR to check your completed work</td>
</tr>
</tbody>
</table>

**YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP**

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td><strong>RETURN</strong></td>
<td>All cleaned tools to their proper place</td>
</tr>
<tr>
<td>12.</td>
<td><strong>CLEAN</strong></td>
<td>Up your work area</td>
</tr>
<tr>
<td>13.</td>
<td><strong>PLACE</strong></td>
<td>Your workpiece in your locker</td>
</tr>
<tr>
<td>14.</td>
<td><strong>GET</strong></td>
<td>Lathe LAP # 5</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Turn Square Shoulder
Performance Objective: After completion of this LAP, you should be able to safely turn a part with square shoulder to length. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Turn square shoulder to length as specified within + - .001 tolerance

References:
4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 5</td>
<td>Lathe LAPs 0 - 4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 5
TURN SQUARE SHOULDER

1. GET
Video tape "Turn a Part with Square Shoulder to Length" from cabinet "A", slot # 56**

2. VIEW
Video tape from footage through

3. REWIND
Video tape and clear the counter

4. RETURN
Video tape to cabinet

5. READ
Job sheet

6. ENTER
Shop using SAFETY procedures

7. GET
Materials and tools as listed on your job sheet

8. GO
To a lathe in Machine Shop Area

9. DO
Job sheet

10. SIGNAL
Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN
All cleaned tools to their proper place

12. CLEAN
Up your work area

13. PLACE
Your workpiece in your locker, to be used in LAP # 6

14. GET
Lathe LAP # 6
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
LATHE LAP # 6

LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Align Work in Four-Jaw Chuck

Performance Objective: After completion of this LAP, you should be able to safely use a dial indicator to align work in a four-jaw chuck. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Use dial indicator to align work in a four-jaw chuck

References
4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 6</td>
<td>Lathe LAPs 0 - 5</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 6
ALIGN WORK IN FOUR-JAW CHUCK

1. GET  Video tape "Align Work in Four-Jaw Chuck" from cabinet "A", slot # 56**
2. VIEW  Video tape from footage ___ through ___
3. REWIND  Video tape and clear the counter
4. RETURN  Video tape to cabinet
5. READ  Job sheet
6. ENTER  Shop using SAFETY procedures
7. GET  Materials and tools as listed on your job sheet
8. GO  To a lathe in Machine Shop Area
9. DO  Job sheet
10. SIGNAL  Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN  All cleaned tools to their proper place
12. CLEAN  Up your work area
13. PLACE  Your workpiece in your locker to use in LAP # 7
14. GET  Lathe LAP # 7
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Chamfer Operation

Performance Objective: After completion of this LAP, you should be able to safely perform chamfer operations to specifications. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task
Perform chamfer operations to specifications

References:
4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 7</td>
<td>Lathe LAPs 0 - 6</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP #7
CHAMFER OPERATIONS

1. GET Video tape "Perform Chamfer Operation" from cabinet "A", slot # 56**
2. VIEW Video tape from footage ___ through ___
3. REWIN Video tape and clear the counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials and tools as listed on your job sheet
8. GO To a lathe in Machine Shop Area
9. DO Job sheet
10. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN All cleaned tools to their proper place
12. CLEAN Up your work area
13. PLACE Your workpiece in your locker, to use again in LAP # 8
14. GET Lathe LAP # 8
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Recessing Operation

Performance Objective: After completion of this LAP, you should be able to safely perform recessing operation to specifications. This knowledge will be demonstrated through a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Perform recessing operation to specifications

References

4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP # | Prerequisites | Time Range
Lathe # 3 | Lathe LAPs 0 - 7 | 3 Hours
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 8
PERFORM RECESSING OPERATIONS

1. GET
   Video tape "Perform Recessing Operation" from cabinet "A", slot # 56**

2. VIEW
   Video tape from footage ___ through ___

3. REWIND
   Video tape and clear the counter

4. RETURN
   Video tape to cabinet

5. READ
   Job sheet

6. ENTER
   Shop using SAFETY procedures

7. GET
   Materials and tools as listed on your job sheet

8. GO
   To a lathe in Machine Shop Area

9. DO
   Job sheet

10. SIGNAL
    Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN
    All cleaned tools to their proper place

12. CLEAN
    Up your work area

13. PLACE
    Your workpiece in your locker, to use again in LAP # 9

14. GET
    Lathe LAP # 9
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
LATHE LAP # 9

LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Center-drilling

Performance Objective: After completion of this LAP, you should be able to safely perform a center-drilling operations to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task
Perform center-drilling operations to specifications

References
4. RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 9</td>
<td>Lathe LAPs 0 - 8</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 9
PERFORM CENTER DRILL OPERATION

1. GET  
   Video tape "Facing & Center Drilling" located in cabinet "A", slot # 4

2. VIEW  
   Video tape from footage ___ through ___

3. REWIND  
   Video tape and clear the counter

4. RETURN  
   Video tape to cabinet

5. READ  
   Job sheet

6. GET  
   Video tape "Perform Center Drill Operation" from cabinet "A", slot # 59

7. VIEW  
   Video tape from footage ___ through ___

8. REWIND  
   Video tape and clear counter

9. RETURN  
   Video tape to cabinet

10. ENTER  
    Shop using SAFETY procedures

11. GET  
    Materials and tools as listed on your Job sheet

12. GO  
    To a lathe in Machine Shop Area

13. DO  
    Job sheet

14. SIGNAL  
    Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

15. RETURN  
    All cleaned tools to their proper place

16. CLEAN  
    Up your work area

17. PLACE  
    Your workpiece in your locker, as you will use it again in LAP # 18

18. GET  
    Lathe LAP # 10
LAP # 10

Medium Knurls
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Knurling

Performance Objective: After completion of this LAP, you should be able to safely perform knurling operation to specification. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Perform knurling operation to specifications

4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 10</td>
<td>Lathe LAPs 0 - 9</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 10
KNURLING

1. GET Video tape "Facing & Center Drilling" from cabinet "A", slot # 4*

2. VIEW Video tape from footage through

3. REWIND Video tapes and clear the counter

4. RETURN Video tapes to cabinet

5. READ Job sheet

6. GET Video tape "Perform A Knurling Operation" from cabinet "A", slot # 59*

7. VIEW Video tape from footage ___ through ___

8. REWIND Video tape and reset counter

9. RETURN Video tape to cabinet

10. ENTER Shop using SAFETY procedures

11. GET Materials and tools as listed on your job sheet

12. GO To a lathe in Machine Shop Area

13. DO Job sheet

14. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

15. RETURN All cleaned tools to their proper place

16. CLEAN Up your work area

17. GET Initial stamps and ball peen hammer

18. STAMP Your initials on workpiece

19. RETURN Initial stamps and ball peen hammer

20. PLACE Your workpiece in your locker

21. GET Lathe LAP # 11
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
LATHE LAP # 11

LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Drilling and Reaming

Performance Objective: After completion of this LAP, you should be able to safely perform drilling and reaming operations to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Tasks

Perform drilling and reaming operations to specifications

References
4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP # Lathe LAPs 0 - 10
Prerequisites Time Range 1 1/2 Hours
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 11
DRILLING AND REAMING

1. GET Video tape "Drill and Ream A Hole" from cabinet "A", slot # 59*
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and clear the counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials and tools as listed on your job sheet
8. GO To a lathe in Machine Shop Area
9. DO Job sheet
10. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN All cleaned tools to their proper place
12. CLEAN Up your work area
13. GET Initial stamps and ball peen hammer
14. STAMP Your initials on workpiece
15. RETURN Initial stamps and ball peen hammer
16. PLACE Your workpiece in your locker
17. GET Lathe LAP # 12
LEARNING ACTIVITY PACKET

Major Instructional Area       Machine Shop
Instructional Unit            Lathe
LAP Title                     Tapping

Performance Objective          After completion of this LAP, you should be able to safely perform tapping operations to specification. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Perform tapping operation to specification

References

4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP #    Prerequisites    Time Range
Lathe # 12          Lathe LAPs 0 - 11          1-1/2 Hours
LEARNING ACTIVITY. PACKET GUIDE
LATHE
LAP # 12
TAPPING

1. GET Video tape "Using Lathe Center to Align and Start A Tap" from cabinet "A", slot # 59*
2. VIEW Video tape from footage ___ through ___
3.REWIND Video tape and clear the counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials and tools as listed on your job sheet
8. GO To a lathe in Machine Shop Area
9. DO Job sheet
10. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN All cleaned tools to their proper place
12. CLEAN Up your work area
13. GET Initial stamps and ball peen hammer
14. STAMP Your initials on workpiece
15. RETURN Initial stamps and ball peen hammer
16. PLACE Your workpiece in your locker
17. GET Lathe LAP # 13
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
LATHE LAP # 13

LEARNING ACTIVITY PACKET

Major Instructional Area  Machine Shop
Instructional Unit          Lathe
LAP Title                  Cut-off Operation

Performance Objective      After completion of this LAP, you should
                           be able to safely perform cut-off operation to specifications. This knowledge
                           will be demonstrated through a job sheet and a unit test with a minimum of 85%
                           accuracy.

Task

Perform cut-off operation to specifications

References
4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 13</td>
<td>Lathe LAPs 0 - 12</td>
<td>1-1/2 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP 13
CUT-OFF OPERATION

1. GET Video tape "Perform Cut-Off Operation" from cabinet "A", slot # 59*
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and clear the counter
4. RETURN Video tape to cabinet "A", slot # 59 *
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials and tools as listed on your job sheet
8. GO To a lathe in Machine Shop Area
9. DO Job sheet
10. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN All cleaned tools to their proper place
12. CLEAN Up your work area
13. GET Initial stamps and ball peen hammer
14. STAMP Your initials on workpiece
15. RETURN Initial stamps and ball peen hammer
16. PLACE Your workpiece in your locker
17. GET Lathe LAP # 14
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Turning Between Centers

Performance Objective: After completion of this LAP, you should be able to safely perform turning between centers operation to specifications. This knowledge will be demonstrated through a job sheet, an evaluation sheet, and a unit test with a minimum of 85% accuracy.

Task

Perform turning between centers operation to specifications

References
4. RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 14</td>
<td>Lathe LAPs 0 - 13</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 14
TURNING BETWEEN CENTERS

1. GET Video tape "Turning Between Centers" from cabinet "A", slot # 4 **
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and clear counter
4. RETURN Video tape to cabinet
5. GET Video tape "Aligning Tail Stock-lathe" from cabinet "A", slot # 17 **
6. VIEW Video tape from footage ___ through ___
7. REWIND Video tape and clear counter
8. RETURN Video tape to cabinet
9. GET Video tape "Turn Between Center" from cabinet "A", slot # 59 **
10. VIEW Video tape from footage ___ through ___
11. REWIND Video tapes and clear the counter
12. RETURN Video tapes to cabinet
13. READ Job sheet
14. ENTER Shop using SAFETY procedures
15. GET Materials and tools as listed on your job sheet
16. GO To a lathe in Machine Shop Area
17. DO Job sheet
18. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

19. RETURN All cleaned tools to their proper place
20. CLEAN Up your work area
21. GET Initial stamps and ball peen hammer
22. STAMP Your initials on workpiece
23. RETURN Initial stamps and ball peen hammer
24. PLACE Your workpiece in your locker, for use in LAP # 15
25. GET Lathe LAP # 15
#4 Morse Taper

1.250"  32°  1.030"

4 1/8"

LAP # 15
LEARNING ACTIVITY PACKET

Major Instructional Area            Machine Shop
Instructional Unit                 Lathe
LAP Title                          Turning Taper with Taper Attachment

Performance Objective              After completion of this LAP, you should be able to safely perform a taper cut with taper attachment. This knowledge will be demonstrated through a job sheet, an evaluation sheet, and a unit test with a minimum of 85% accuracy.

Task

Perform a taper cut with taper attachment

4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP #                                  Prerequisites                  Time Range
Lathe # 15                              Lathe LAPs 0 - 14               4-1/2 Hours
1. GET Video tape "Cutting Tapers-Compound Rest" from cabinet "A", slot 5**
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and clear counter
4. RETURN Video tape to cabinet
5. GET Video tape "Cutting Tapers - of Tailstock" from cabinet "A", slot 13**
6. VIEW Video tape from footage ___ through ___
7. REWIND Video tape and clear the counter
8. RETURN Video tape to cabinet
9. READ Job sheet
10. GET Video tape "Turn a Tap with A Taper Attachment" from cabinet "A", slot # 59**
11. VIEW Video tape from footage ___ through ___
12. REWIND Video tape and clear counter
13. RETURN Video tape to cabinet
14. ENTER Shop using SAFETY procedures
15. GET Materials and tools as listed on your job sheet
16. GO To a lathe in Machine Shop Area
17. DO Job sheet
18. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

19. RETURN All cleaned tools to their proper place
20. CLEAN Up your work area
24. PLACE Your workpiece in your locker
25. GET Lathe LAP # 16
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
LATHE LAP # 16

LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Turn Taper with a Compound

Performance Objective: After completion of this LAP, you should be able to safely perform taper turning with a compound to specifications. This knowledge will be demonstrated through a job sheet, an evaluation sheet, and a unit test with a minimum of 85% accuracy.

Task
Perform taper turning with a compound to specifications

References
4. RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP # 16
Prerequisites: Lathe LAPs 0 - 15
Time Range: 3 Hours
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 16
TURN TAPER WITH A COMPOUND

1. GET Video tape "Turn A Taper with A Compound" from cabinet "A", slot # 59**
2. VIEW Video tape from footage ____ through ____
3. REWIND Video tape and clear the counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials and tools as listed on your job sheet
8. GO To a lathe in Machine Shop Area
9. DO Job sheet
10. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN All cleaned tools to their proper place
12. CLEAN Up your work area
13. GET Initial stamps and ball peen hammer
14. STAMP Your initials on workpiece
15. RETURN Initial stamps and ball peen hammer
16. PLACE Your workpiece in your locker
17. GET Lathe LAP # 17
LEARNING ACTIVITY PACKET

Major Instructional Area   Machine Shop
Instructional Unit          Lathe
LAP Title                  Boring Operation

Performance Objective      After completion of this LAP, you should
                            be able to safely perform boring operations to specifications. This knowledge
                            will be demonstrated through a job sheet, an evaluation sheet, and a unit test
                            with a minimum of 85% accuracy.

Task

Perform a boring operation to specifications

References

4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP #   Prerequisites             Time Range
Lathe # 17   Lathe LAPs 0 - 16   3 Hours
1. GET Video tape "Perform Boring Operation" from cabinet "A", slot # 59**

2. VIEW Video tape from footage ____ through ____

3. REWIND Video tape and clear the counter

4. RETURN Video tape to cabinet

5. READ Job sheet

6. ENTER Shop using SAFETY procedures

7. GET Materials and tools as listed on your job sheet

8. GO To a lathe in Machine Shop Area

9. DO Job sheet

10. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN All cleaned tools to their proper place

12. CLEAN Up your work area

13. GET Initial stamps and ball peen hammer

14. STAMP Your initials on workpiece

15. RETURN Initial stamps and ball peen hammer

16. PLACE Your workpiece in your locker

17. GET Lathe LAP # 18
Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Cut External Threads to A Relief
Performance Objective: After completion of this LAP, you should be able to safely cut external threads to a relief as specified. This knowledge will be demonstrated through a job sheet, an evaluation sheet, and a unit test with a minimum of 85% accuracy.

Task:
Cut external threads to a relief as specified

References:
4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP #  Lathe LAP # 18  Prerequisites: Lathe LAPs 0 - 17  Time Range: 3 Hours
LEARNING ACTIVITY PACKET GUIDE
LATHE
LAP # 18
CUT EXTERNAL THREADS TO A RELIEF

1. GET Video tape "External Threading on Lathe" from cabinet "A", slot # 8*
2. VIEW Video tape from footage ____ through ____
3. REWIND Video tape to cabinet
4. RETURN Video tape to cabinet
5. GET Video tape "Lathe-cutting Threads with Die" from cabinet "A", slot # 16**
6. VIEW Video tape from footage ____ through ____
7. REWIND Video tape to cabinet
8. RETURN Video tape to cabinet
9. READ Job sheet
10. GET Video tape "Cut External Threads to A Relief" from cabinet "A", slot # 62*
11. VIEW Video tape from footage ____ through ____
12. REWIND Video tape to cabinet
13. RETURN Video tape to cabinet
14. ENTER Shop using SAFETY procedures
15. GET Materials and tools as listed on your job sheet
16. GO To a lathe in Machine Shop Area
17. DO Job sheet
18. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

19. RETURN All cleaned tools to their proper place
20. CLEAN Up your work area
24. PLACE Your workpiece in your locker
25. GET Lathe LAP # 19
LEARNING ACTIVITY PACKET

Major Instructional Area       Machine Shop
Instructional Unit            Lathe
LAP Title                     Pick Up Threads

Performance Objective          After completion of this LAP, you should be able to safely perform thread pick up to specification. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Perform thread pick up to specification

References

4 - RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe # 19</td>
<td>Lathe LAPs 0 - 18</td>
<td>1-1/2 Hours</td>
</tr>
</tbody>
</table>
I. Equipment and materials

Right-hand threading tool
Center gauge
Steel rule, 6"
Lathe with four-jaw chuck
Quick-change tool post and toolholder
Threaded stud, 1.0", from Tray # __

II. Procedure

(NOTE: This procedure may be required on a bolt that has damaged threads, or when a threading tool is removed, sharpened, and put back in toolholder.)

A. Check all oil levels and perform daily maintenance

B. Set compound 30 degrees to right of cross feed

C. Set lathe speed

D. Chuck bolt and align

E. Mount threading tool in toolholder, adjust center height, and use center gauge to square tool to axis of bolt

F. Set carriage controls to cut eight (8) threads per inch

G. Move carriage to right so that tool clears end of bolt 1/8" from work

H. Start spindle and engage half-nut lever; allow tool to travel to left until it is about 1/2" to the left of end of bolt; stop spindle (Figure 1)

(NOTE: Do NOT disengage the half-nut lever yet.)
Major Instructional Area: Machine Shop
Instructional Unit: Lathe
LAP Title: Cut Internal Threads

Performance Objective: After completion of this LAP, you should be able to safely perform internal thread cutting to specifications. This knowledge will be demonstrated through a job sheet, an evaluation sheet, and a unit test with a minimum of 85% accuracy.

Task

Perform internal thread cutting to specifications

References
4. RMI., Video Tape. Safety on South Bend Lathe. Kansas City, MO.

LAP # | Prerequisites | Time Range
--- | --- | ---
Lathe # 20 | Lathe LAPs 0 - 19 | 4-1/2 Hours
1. GET Video tape "Internal Threading - Lathe" from cabinet "A", slot 17#

2. VIEW Video tape from footage through ___

3. REWIND Video tape and clear the counter

4. RETURN Video tape to cabinet

5. READ Job sheet

6. GET Video tape "Cut Internal Threads" from cabinet "A", slot # 62**

7. VIEW Video tape from footage through ___

8. REWIND Video tape and clear the counter

9. RETURN Video tape to cabinet

10. READ Job sheet

11. ENTER Shop using SAFETY procedures

12. GET Materials and tools as listed on your job sheet

13. GO To a lathe in Machine Shop Area

14. DO Job sheet

15. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

16. RETURN All cleaned tools to their proper place

17. CLEAN Up your work area

18. GET Initial stamps and ball peen hammer

19. STAMP Your initials on workpiece

20. RETURN Initial stamps and ball peen hammer

21. PLACE Your workpiece in your locker

22. SEE YOUR INSTRUCTOR FOR YOUR NEXT AREA OR ASSIGNMENT
VERTICAL MILL

HORIZONTAL MILL

SURFACE GRINDING

BROACHING
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: SAFETY

Performance Objective: After completion of this LAP, you should be able to state safety and operational procedures for the vertical milling machine. This knowledge will be demonstrated through an assignment sheet, a safety sheet (100% required), a job sheet and a unit test with a minimum of 85% accuracy.

Tasks

Demonstrate knowledge of safety procedures regarding vertical milling.

Identify vertical milling machine controls

Define vertical milling operations

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK
4 - RMI., Video tape, "Mill Safety" and "Basic Milling Procedures", Kansas City, MO.

LAP # Prerequisites Time Range
V. MILL 0 Bench Metals LAPs 0 - 10 1/2 Hour
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>GET</td>
<td>Video tape RMI - &quot;Basic Milling Procedures&quot; from cabinet &quot;A&quot;, slot # 9 **</td>
</tr>
<tr>
<td>2.</td>
<td>VIEW</td>
<td>Video tape</td>
</tr>
<tr>
<td>3.</td>
<td>REWIND</td>
<td>Video tape and reset counter</td>
</tr>
<tr>
<td>4.</td>
<td>RETURN</td>
<td>Video tape to cabinet</td>
</tr>
<tr>
<td>5.</td>
<td>REVIEW</td>
<td>Study sheets</td>
</tr>
<tr>
<td>6.</td>
<td>COMPLETE</td>
<td>Assignment sheets</td>
</tr>
<tr>
<td>7.</td>
<td>CHECK</td>
<td>Assignment sheets</td>
</tr>
<tr>
<td>8.</td>
<td>GET</td>
<td>Video tape &quot;Mill Safety&quot; from cabinet &quot;A&quot;, slot # 9 *</td>
</tr>
<tr>
<td>9.</td>
<td>VIEW</td>
<td>Video tape</td>
</tr>
<tr>
<td>10.</td>
<td>REWIND</td>
<td>Video tape and reset counter</td>
</tr>
<tr>
<td>11.</td>
<td>RETURN</td>
<td>Video tape to cabinet</td>
</tr>
<tr>
<td>12.</td>
<td>TAKE</td>
<td>SAFETY TEST</td>
</tr>
<tr>
<td>13.</td>
<td>CHECK</td>
<td>Safety Test</td>
</tr>
<tr>
<td>14.</td>
<td>GO</td>
<td>To your INSTRUCTOR with your Safety Test Answers</td>
</tr>
</tbody>
</table>

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

15. GET LAP V. Mill # 1
VERTICAL MILL

LAP # 1

£70
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Cutter Holder

Performance Objective: After completion of this LAP, you should be able to mount and remove cutter and cutter holder. This knowledge will be demonstrated through an assignment sheet, a job sheet and a unit test with a minimum of 85% accuracy.

Task

Mount and remove cutter and cutter holder as specified

References
1. Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

LAP # Prerequisites Time Range
V. Mill - 1 V. Mill LAP 0 1/2 Hour
LEARNING ACTIVITY PACKET GUIDE
VERTICAL MILLING
LAP # 1
CUTTER HOLDER

1. GET Video tape "Mount & Remove Cutter & Cutter Holders" from cabinet "A", slot # 68 **
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. REVIEW Study sheet
6. READ Job sheet
7. ENTER Shop using SAFETY procedures
8. GET Materials needed
9. DO Job sheet
10. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN All materials to their proper places
12. CLEAN Up your work area
13. GET LAP V, Mill # 2
Table Locks
Saddle Lock
Graduated Collars (Discs)
Elevating Handcrank
Cross-Feed Handcrank
Knee Lock
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Machine Controls

Performance Objective: After completion of this LAP, you should be able to operate vertical milling machine controls. This knowledge will be demonstrated through an assignment sheet, a job sheet and a unit test with a minimum of 85% accuracy.

Task
Demonstrate use of specified machine controls

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 2</td>
<td>V. Mill LAPs 0 &amp; 1</td>
<td>1/4 Hour</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
VERTICAL MILLING
LAP # 2
MACHINE CONTROLS

1. GET Video tape "Use Machine Controls Properly" from cabinet "A", slot # 68 **
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET All materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO 'CONTINUE ON WITH THIS LAP

11. RETURN All materials to their proper places
12. CLEAN Your work area
13. GET LAP V. Mill # 3
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Mount and Align Vise

Performance Objective: After completion of this LAP, you should be able to properly mount and align a vise. This knowledge will be demonstrated through an assignment sheet, a job sheet and a unit test with a minimum of 85% accuracy.

Task

Mount and align a vise as specified to within a + - .001 tolerance

References

1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

LAP #   Prerequisites   Time Range
V. Mill - 3   V. Mill LAPs 0, 1, & 2   1/4 Hour
1. GET Video tape "Mount & Align Vise" from cabinet "A", slot # 68 **

2. VIEW Video tape from footage ____ through ____

3.REWIND Video tape and reset counter

4. RETURN Video tape to cabinet

5. READ Job sheet

6. ENTER Shop using SAFETY procedures

7. GET Materials needed

8. DO Job sheet

9. SIGNAL Your INSPECTOR to check your complete work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. RETURN Materials to their proper places

11. CLEAN Up your work area

12. GET LAP V. Mill # 4
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Align Head Square to Table

Performance Objective: After completion of this LAP, you should be able to align head square to mill table. This knowledge will be demonstrated through an assignment sheet, a job sheet and a unit test with a minimum of 85% accuracy.

Task

Align head square to table as specified to within + - .001 tolerance

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 4</td>
<td>V. Mill LAPs 0 - 3</td>
<td>1/4 Hour</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
VERTICAL MILLING
LAP # 4
ALIGN HEAD SQUARE TO TABLE

1. GET Video tape "Align Head Square to Table" from cabinet "A", slot # 68 **
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. RETJRN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. DO Job sheet
8. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO
CONTINUE ON WITH THIS LAP

9. GET LAP V. Mill # 5
VERTICAL MILL

LAP # 5
Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Square Stock to Size

Performance Objective: After completion of this LAP, you should be able to safely square aluminum stock to size as specified. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Demonstrate squaring aluminum stock to size as specified

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 5</td>
<td>V. Mill LAPs 0 - 4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
VERTICAL MILLING
LAP # 5
SQUARE ALUMINUM STOCK TO SIZE

1. REVIEW Study sheets
2. READ Job sheet
3. ENTER Shop using SAFETY procedures
4. GET Materials and tools needed
5. DO Job sheet
6. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

7. RETURN Materials and tools to their proper places
8. CLEAN Up your work area
9. GET Your initial stamps and a ball peen hammer
10. STAMP Your initials on the bottom of squared stock
11. RETURN Initial stamps and ball peen hammer
12. STORE Workpiece in your locker (you will use it in LAP # 6)
13. GET LAP V. Mill # 6
**INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM**
**LIBBEY SKILL CENTER, TOLEDO, OHIO**
**VERTICAL MILL LAP # 6**

**LEARNING ACTIVITY PACKET**

**Major Instructional Area**  
Machine Shop

**Instructional Unit**  
Vertical Milling

**LAP Title**  
Hole Conditioning

**Performance Objective**  
After completion of this LAP, you should be able to perform hole conditioning to specifications. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

**Task**

Perform hole conditioning to specifications

**References**

1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 6</td>
<td>V. Mill LAP 0 - 5</td>
<td>4-1/2 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
VERTICAL MILLING
LAP # 6
HOLE CONDITIONING

1. REVIEW Study sheets
2. READ Job sheet
3. ENTER Shop using SAFETY procedures
4. GET Materials and tools needed
5. DO Job sheet
6. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

7. RETURN All materials and tools to their proper places
8. CLEAN Up your work area
9. GET LAP V. Mill # 7
VERTICAL MIL

2.00" ± .010"

.187"

.875" ± .005"

.500" ± .005"

6.000" ± .005"

LAP # 7

294
LEARNING ACTIVITY PACKET

Major Instructional Area Machine Shop
Instructional Unit Vertical Milling
LAP Title Side Milling
Performance Objective After completion of this LAP, you should be able to perform side milling to specifications. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Perform specified side milling operation to within + - .010 tolerance

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill -7</td>
<td>V. Mill LAPs 0 - 4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Perform Side Milling Operations" from cabinet "A", slot # 71 *

2. VIEW Video tape from footage ___ through ___

3. REWIND Video tape and reset counter

4. RETURN Video tape to cabinet

5. READ Job sheet

6. ENTER Shop using SAFETY procedures

7. GET Materials needed

8. DO Job sheet

9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. RETURN Materials and tools to their proper places

11. CLEAN Up your work area

12. GET Your initial stamps and a ball peen hammer

13. STAMP Your initials on your workpiece

14. RETURN Your initial stamps and ball peen hammer

15. STORE Your workpiece in your locker

16. GET LAP V. Mill # 8
VERTICAL MILL

End Mill

Workpiece

LAP # 8
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: End Milling

Performance Objective: After completion of this LAP, you should be able to perform end milling operation to specifications. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Perform end milling operation to specifications within ± .010 tolerance

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 8</td>
<td>V. Mill LAPs 0 - 7</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "End Milling Operations" from cabinet "A", slot # 71 *
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. RETURN All materials to their proper places
11. CLEAN Up your work area
12. GET Your initial stamps and a ball peen hammer
13. STAMP Your initials on your workpiece
14. RETURN Your initial stamps and ball peen hammer
15. PLACE Your workpiece in your locker
16. GET LAP V. MILL # 9
1/4" Key Slot
+.000"
-.001"

#11 Woodruff Centered Within .001"
Key Seat .276" Deep ± .002"

21/8"+.005"
-.000"

3/16"

.LAP # 9

300
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Key Seating and Key Slotting

Performance Objective: After completion of this LAP, you should be able to perform keyseat and key slot milling operations to specifications. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Tasks

Mill keyseat with keyseat cutter and a key slot with end mill to specifications with a tolerance of ± .010

References

1. Dunn, James., Machine Shop Milling Machines, State Department of Vocational and technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 9</td>
<td>V. Mill LAPs 0 - 8</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Mill A Key Seat" from cabinet "A", slot # 71 *
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. RETURN All materials to their proper places
11. CLEAN Up your work area
12. GET LAP V. Mill # 10
LEARNING ACTIVITY PACKET

Major Instructional Area  Machine Shop
Instructional Unit  Vertical Milling
LAP Title  Rectangular Slot (Pocket Milling)

Performance Objective  After completion of this LAP, you should be able to mill a rectangular slot to specifications. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Mill a rectangular slot to specifications within a tolerance of + - .010

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 10</td>
<td>V. Mill LAPs 0 - 9</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Mill A Rectangular Pocket" from cabinet "A", slot 71 **
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. RETURN All materials to their proper places
11. CLEAN Up your work area
12. GET LAP V. Mill # 11
VERTICAL MILL

LAP # 11
Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Locating, Drilling and Reaming of Holes

Performance Objective: After completion of this LAP you should be able to locate, drill, and ream holes to specification. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Tasks:
Perform precision locating, drilling, and reaming of holes to specifications within a tolerance of ± .001

References:
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 11</td>
<td>V. Mill LAPs 0 - 10</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Precision Locating, Drilling, and Reaming" from cabinet "A", slot # 71 **
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET All materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. RETURN All materials to their proper places
11. TEAR Down your setup
12. CLEAN Up your work area
13. GET LAP V. Mill # 12
VERTICAL MILL

Front View

Clamp

Indicator Plunger

Top View

Workpiece

Indicator Plunger

+y

-x

-y

+x

LAP # 12

309
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Align a Bore to Spindle

Performance Objective: After completion of this LAP, you should be able to safely align a bore to spindle to perform specified work. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task

Demonstrate ability to align a bore concentric to the spindle as specified

References
1. Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 12</td>
<td>V. Mill LAPs 0 - 11</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
VERTICAL MILLING
LAP # 12
ALIGN A BORE TO SPINDLE

1. GET Video tape "Align and Bore" from cabinet "A", slot # 71
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET All materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. RETURN All materials to their proper places
11. CLEAN Up your work area
12. GET Your initial stamps and a ball peen hammer
13. STAMP Your initials on your workpiece
14. RETURN Your initial stamps and ball peen hammer
15. PLACE Your workpiece in your locker
16. GET LAP V. Mill # 13
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Vertical Milling
LAP Title: Boring
Performance Objective: After completion of this LAP, you should be able to safely perform a boring operation to specification. This knowledge will be demonstrated through an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

Task:
Perform a boring operation to specifications within a tolerance of + - .003

References:
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Mill - 13</td>
<td>V. Mill LAPs 0 - 12</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Perform A Boring Operation" from cabinet "A", slot # 71 **

2. VIEW Video tape from footage ___ through ___

3. REWIND Video tape and reset counter

4. RETURN Video tape to cabinet

5. READ Job sheet

6. ENTER Shop using SAFETY procedures

8. GET Materials needed

9. DO Job sheet

10. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. RETURN All materials to their proper places

12. CLEAN Up your work area

13. PLACE Your workpiece in your locker

14. SEE Your INSTRUCTOR for next area of assignment
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Horizontal Mill
LAP Title: SAFETY and Orientation

Performance Objective: After completion of this LAP, you should be able to state safety for the horizontal milling machine. This knowledge will be demonstrated through a safety test (100% accuracy required), assignment sheets, a job sheet, and a unit test with a minimum of 85% accuracy.

Tasks

Demonstrate knowledge of safety procedures regarding horizontal milling
Identify horizontal milling machine controls

References
1. Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK
4. RMI, Video Tape. Safety - Horizontal Mill. Kansas City, MO.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>H. Mill # 0</td>
<td>Bench Metal LAPs 0 - 10</td>
<td>1 Hours</td>
</tr>
<tr>
<td></td>
<td>Lathe LAPs 0 - 9</td>
<td></td>
</tr>
</tbody>
</table>

316
1. GET Video tape "Safety - Horizontal Mill" from cabinet "A", slot # 14*
   Video tape "Use Controls Properly on A Horizontal Mill" from cabinet "A", slot # 62*
2. VIEW Video tape footage ___ through ___
3. REWIND Video tapes and reset counter
4. RETURN Video tapes to cabinet
5. TAKE SAFETY TEST
6. REVIEW Study sheet
7. COMPLETE Assignment sheets
8. READ Job sheet
9. ENTER Machine shop using SAFETY procedures
10. GI/E Your Safety Test to your INSTRUCTOR
11. GET Materials needed
12. DO Job sheet
13. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

14. CLEAN Up your work area
15. RETURN Materials to proper place
16. GET H. Mill LAP # 1
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Horizontal Mill
LAP Title: Arbor Mounting

Performance Objective: After completion of this LAP, you should be able to mount arbor using correct procedures and to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Demonstrate mounting of an arbor to specifications

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

LAP # | Prerequisites | Time Range
--- | --- | ---
H. Mill # 1 | H. Mill LAP # 0 | 1 Hour
1. GET Video tape "Mount A 'Style A' and Adjust Arbor Support Bushing" from cabinet "A", slot # 62**
2. VIEW Video tape footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet "A", slot # 62 **
5. READ Job sheet
6. ENTER Machine shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. CLEAN Up your work area
11. RETURN Materials to proper place
12. GET H. Mill LAP # 2
LEARNING ACTIVITY PACKET

Major Instructional Area  Machine Shop
Instructional Unit        Horizontal Mill
LAP Title                Mount Cutter to Arbor

Performance Objective After completion of this LAP, you should be able to mount the cutter to the arbor as specified. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Demonstrate the ability to mount cutter to arbor as specified

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>H. Mill # 2</td>
<td>H. Mill LAPs 0 &amp; 1</td>
<td>1 Hour</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
HORIZONTAL MILLING
H. MILL - 2
MOUNT CUTTER TO ARBOR

1. GET Video tape "Horizontal Mill - Mount Cutter to Arbor Base" from cabinet "A", slot # 65*
2. VIEW Video tape footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet "a", slot # 65 *
5. READ Job sheet
6. ENTER Machine shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. CLEAN Up your work area
11. RETURN Materials to proper place
12. GET H. Mill LAP # 3
LEARNING ACTIVITY PACKET

Major Instructional Area: Machine Shop
Instructional Unit: Horizontal Mill
LAP Title: Align a Vise

Performance Objective: After completion of this LAP, you should be able to align a vise to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Demonstrate the alignment of a vise as specified

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

LAP #   Prerequisites   Time Range
H. Mill # 3   H. Mill LAPs 0 - 2   1 Hour
LEARNING ACTIVITY PACKET GUIDE
HORIZONTAL MILLING
H. MILL - 3
ALIGN A VISE

1. GET Video tape "Horizontal Mill Mount and Align Swivel-Base Vise" from cabinet "A", slot # 14*

2. VIEW Video tape footage ___ through ___

3. REWIND Video tape and reset counter

4. RETURN Video tape to cabinet "A", slot # 14 *

5. READ Job sheet

6. ENTER Machine shop using SAFETY procedures

7. GET Materials needed

8. DO Job sheet

9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. CLEAN Up your work area

11. RETURN Materials to proper place

12. GET H. Mill LAP # 4
LEARNING ACTIVITY PACKET

Major Instructional Area          Machine Shop
Instructional Unit                Horizontal Mill
LAP Title                         Key Slot

Performance Objective: After completion of this LAP, you should be able to mill a key slot to specification within a tolerance of + - .010. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Demonstrate the ability to mill a key slot to specification within a tolerance of + - .010

References
1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>H. Mill # 5</td>
<td>H. Mill LAPs 0 - 4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
HORIZONTAL MILLING
H. MILL - 5
MILL A KEYWAY WITH STAGGERED-TOOTH MILL CUTTER

1. GET Video tape "Mill A Keyway" from cabinet "A", slot # 68 *
2. VIEW Video tape footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet "A", slot # 68 *
5. READ Job sheet
6. ENTER Machine shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. CLEAN Up your work area
11. RETURN Materials to proper place
12. GET Initial stamps and a ball peen hammer
13. STAMP Initials on workpiece
14. RETURN Initial stamps and ball peen hammer
15. PLACE Workpiece in your locker
16. SEE Your INSTRUCTOR for your assignment
Cutter Rotation

Workpiece

Graduated Collar

Elevating Handcrank

Feed

End of Workpiece

Cutter

Feed
LEARNING ACTIVITY PACKET

Major Instructional Area  Machine Shop
Instructional Unit       Horizontal Mill
LAP Title               Mill A Square

Performance Objective   After completion of this LAP, you should be able to mill a square to specification within a tolerance of ± .010. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Demonstrate ability to mill a square to specifications within ± .010 tolerance

References 1 - Dunn, James., Machine Shop Milling Machines, State Department of Vocational and Technical Education, 1983, Stillwater, OK

LAP #  Prerequisites  Time Range
H. Mill # 4  H. Mill LAPs 0 - 3  3 Hours
LEARNING ACTIVITY PACKET GUIDE
HORIZONTAL MILLING
H. MILL - 4
MILL A SQUARE

1. GET Video tape "Mill Square A Workpiece Mounted in A Vise" from cabinet "A", slot # 14 *
2. VIEW Video tape
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet "A", slot # 14 *
5. READ Job sheet
6. ENTER Machine shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. TEAR Down setup
11. CLEAN Your work area
12. RETURN Materials to proper place
13. GET Initial stamps and a ball peen hammer
14. STAMP Initials on workpiece
15. RETURN Initial stamps and ball peen hammer
16. PLACE Workpiece in your locker
17. GET H. Mill LAP # 5
LEARNING ACTIVITY PACKET

Major Instructional Area	Machine Shop
Instructional Unit	Broaching
LAP Title	Keyway Broaching

Performance Objective	After completion of this LAP, you should be able to state safety and operational procedures for hand broaching of an internal keyway. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Perform hand broaching operations to cut an internal keyway


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR # 1</td>
<td></td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW
   Study sheet

2. READ
   Job sheet

4. ENTER
   Shop using SAFETY procedures

5. GET
   Materials needed

5. DO
   Job sheet

6. SIGNAL
   Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

7. RETURN
   Materials to their proper place

8. CLEAN
   Up your work area

9. SEE
   Your INSTRUCTOR for your next assignment
LEARNING ACTIVITY PACKET

Major Instructional Area | Machine Shop
Instructional Unit | Surface Grinding
LAP Title | Surface Grinding

Performance Objective | After completion of this LAP, you should be able to safely state safety and operational procedures and surface grind a workpiece square and parallel. This knowledge will be demonstrated through an assignment sheet, a safety test (100% required), a job sheet, and a unit test with a minimum of 85% accuracy.

Tasks

State SAFETY procedures related to surface grinding

Surface grind a workpiece square and parallel

References


LAP # | Prerequisites | Time Range
--- | --- | ---
S. G. # 1 | H. Mill LAPs 0 - 5 | 3 Hours
1. REVIEW Study sheets
2. COMPLETE Assignment sheet
3. TAKE Safety test
4. GIVE Your answers to the Safety Test to your INSTRUCTOR
5. READ Job sheet
6. ENTER Shop using SAFETY procedures
7. GET Materials needed
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

10. CLEAN Up your work area
11. RETURN All materials to their proper place
12. SEE Your INSTRUCTOR for your next assignment
FABRICATION LEARNING ACTIVITY PACKETS
METAL FABRICATION

SHEET METAL

WELDING

WELDING OXY-ACETYLENE
Use RED HANDLE AVIATION SNIPS

Use GREEN HANDLE AVIATION SNIPS

LAP # 1

341
LEARNING ACTIVITY PACKET

Major Instructional Area: Metal Fabrication
Instructional Unit: Sheet Metal
LAP Title: Layout, Hand Shearing, & Punching

Performance Objective: After completion of this LAP, you should be able to safely perform sheet metal layouts, hand shearing, and hand punching to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Tasks
Perform layout, hand shearing, and hand punching on flat sheet stock

Reference
1 - Wireman, Terry., Industrial Maintenance, Reston Publishing Co., 1983, Reston, VA

LAP # | Prerequisites | Time Range
--- | --- | ---
Sh-Metal # 1 | Orientation LAP | 3 Hours
LEARNING ACTIVITY PACKET GUIDE
SHEET METAL
LAP # 1

1. REVIEW  Study sheet
2. READ "Job Sheet" Identify tools, materials needed, and procedures
3. ENTER Shop using SAFETY procedures
4. GET Materials and tools as listed on your Job Sheet
5. GO To large table in the METAL FABRICATION AREA of the shop
6. DO Job Sheet # 1
7. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

8. RETURN All tools to their proper place in the tool room
9. CLEAN Up your work area
10. GET Sheet Metal LAP # 2
V-Notch
3 1/4 x 6

Slant Notch
2 1/4 x 2 3/4

Straight Notch
2 1/4 x 4

LAP #2
344
Major Instructional Area: Metal Fabrication
Instructional Unit: Sheet Metal
LAP Title: Notching
Performance Objective: After completion of this LAP, you should be able to safely perform sheet metal operations for straight, V, and slant notching. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Tasks
Demonstrate proper technique for straight, V, and slant notching

Reference
1 - Bruce, Leroy F., Meyer, Leo A., Sheet Metal Shop Practice, American Technical Society, 1972, Chicago, IL

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sh-Metal # 2</td>
<td>Sh-Metal LAP # 1</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

345
LEARNING ACTIVITY PACKET GUIDE
SHEET METAL
LAP # 2
NOTCHING

1. REVIEW
   Study sheet

2. READ
   "Job Sheet" Identify tools, materials needed and procedures

3. ENTER
   Shop using SAFETY procedures

4. GET
   Materials and tools as listed on your Job Sheet

5. GO
   To the large table in the METAL FABRICATION AREA of the shop

6. DO
   Job sheet #2

7. SIGNAL
   Your INSPECTOR to check your completed work

   YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

8. RETURN
   All tools to their proper place in the tool room

9. GET & DO
   The initial stamp and a ball peen hammer and place your initials on the back side of your work and return stamps to tool room

10. CLEAN
    Up your work area

11. GET
    Sheet Metal LAP # 3
SHEET METAL

LAP # 3

3/16

1 1/2

4 7/8

1 1/2

3/16
LEARNING ACTIVITY PACKET

Major Instructional Area: Metal Fabrication
Instructional Unit: Sheet Metal
LAP Title: Joining Exercise

Performance Objective: After completion of this LAP, you should be able to safely perform sheet metal joining operations with hems, spot weld, and pop riveting. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Tasks

- Perform layout and cutting to specifications
- Perform outside seam, inside seam, and groove seam to specifications
- Perform spot weld and pop rivet to specifications

Reference


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sh-Metal # 3</td>
<td>Sh. Metal LAPs 1 &amp; 2</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. **GET** Video tape "Sheet Metal Joining" from cabinet # ____, slot # ____.

2. **VIEW** Video tape footage ____ through ____

3. **REWIND** Video tape and reset counter

4. **RETURN** Video tape to cabinet

5. **READ** Job sheet

6. **ENTER** Shop using SAFETY procedures

7. **GET** Materials and tools as listed on your Job Sheet

8. **GO** To large table in the METAL FABRICATION AREA of the shop

9. **DO** Job Sheet # 3

10. **SIGNAL** Your INSPECTOR to check your completed work

   YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

11. **RETURN** All tools to their proper place in the tool room

12. **CLEAN** Up your work area

13. **GET** Your initial stamp and a ball peen hammer

14. **PLACE** Your initials on the back side of piece

15. **RETURN** Your initial stamp and ball peen hammer

16. **GET** Sheet Metal LAP # 4
LEARNING ACTIVITY PACKET

Major Instructional Area: Metal Fabrication
Instructional Unit: Sheet Metal
LAP Title: Construct a Rectangular Box
Performance Objective: After completion of this LAP, you should be able to safely construct a sheet metal rectangular box to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task
Construct sheet metal rectangular box

Reference
1 - Wireman, Terry., Industrial Maintenance, Reston Publishing Co., 1983, Reston, VA
2 - Zinigrabe, Claude J., Schumacher, Fred W., Sheet Metal Hand Processes, 1974, Delmar Publishers

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sh-Metal # 4</td>
<td>Sh-Metal LAPs 1 - 3</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
SHEET METAL
LAP # 4
CONSTRUCT RECTANGULAR BOX

1. GET  Video tape "Sheet Metal Rectangular Box Construction" from cabinet # ____, slot # ____
2. VIEW  Video tape footage ____ through ____
3. REWIND  Video tape and reset counter
4. RETURN  Video tape to cabinet
5. REVIEW  Study Sheets
6. READ  Job Sheet
7. ENTER  Shop using SAFETY procedures
8. GET  Materials and tools as listed on your Job Sheet
9. GO  To large table in the METAL FABRICATION AREA of the shop
10. DO  Job Sheet #4
11. SIGNAL  Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

12. RETURN  All tools to their proper place in the tool room
13. CLEAN  Up your work area
14. GET  Your initial stamp and a ball peen hammer
15. PLACE  Your initials on the under side of your box
16. RETURN  Your initial stamp and ball peen hammer
17. GET  Sheet Metal LAP # 5

352
LEARNING ACTIVITY PACKET

Major Instructional Area: Metal Fabrication  
Instructional Unit: Sheet Metal  
LAP Title: Coupling Guard  

Performance Objective:  
After completion of this LAP, you should be able to safely construct a coupling guard to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task:  
Construct a coupling guard to specifications

Reference:  
1 - Wireman, Terry., Industrial Maintenance, Reston Publishing Co., 1983, Reston, VA  
2 - Zifnagruke, Claude J., Schumacher, Fred W., Sheet Metal Hand Processes, 1974, Delmar Publishers

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sh-Metal # 5</td>
<td>Sh-Metal LAPs 1 - 4</td>
<td>2 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
SHEET METAL
LAP # 5
CONSTRUCT COUPLING GUARD

1. GET Video tape "Sheet Metal Coupling Guard" located in cabinet # ____, slot # ____

2. VIEW Video tape footage ____ through ____

3. REWIND Video tape and reset counter

4. RETURN Video tape to cabinet

5. REVIEW Study sheet

6. READ Job sheet

7. ENTER Shop using SAFETY procedures

8. GET Materials and tools as listed on your Job sheet

9. GO To large table in the METAL FABRICATION AREA of the shop

10. DO Job sheet # 5

11. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

12. RETURN All tools to their proper place in the tool room

13. CLEAN Up your work area

14. GET Your initial stamp and a ball peen hammer

15. PLACE Your initials on the under side of your guard

16. RETURN Your initial stamp and ball peen hammer

17. GET Sheet Metal LAP # 6
LEARNING ACTIVITY PACKET

Major Instructional Area: Metal Fabrication
Instructional Unit: Sheet Metal
LAP Title: Cylinder with 1/4" Groove Seam

Performance Objective: After completion of this LAP, you should be able to safely construct a cylinder with 1/4" groove seam from flat sheet metal to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Construct a round pipe with 1/4" groove seam from flat sheet metal to specifications

Reference
1 - Wireman, Terry., Industrial Maintenance, Reston Publishing Co., 1983, Reston, VA

LAP #     Prerequisites     Time Range
Sh-Metal # 6     Sh-Metal LAP's 0 - 5     3 Hours
LEARNING ACTIVITY PACKET GUIDE
SHEET METAL
LAP # 6
CONSTRUCT A CYLINDER

1. GET Video tape "Sheet Metal Cylinder Construction" located in cabinet # ___, slot # ___
2. VIEW Video tape footage ___ through ___
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. REVIEW Study sheet
6. READ Job sheet
7. ENTER Shop using SAFETY procedures
8. GET Materials and tools as listed on your Job sheet
9. GO To large table in the METAL FABRICATION AREA of the shop
10. DO Job sheet # 6
11. SIGNAL Your INSPECTOR to check your completed work
   YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP
12. RETURN All tools to their proper place in the tool room
13. CLEAN Up your work area
14. GET Your initial stamp and a ball peen hammer
15. PLACE Your initials on your cylinder
16. RETURN Your initial stamp and ball peen hammer
17. GET Sheet Metal LAP # 7
LEARNING ACTIVITY PACKET

Major Instructional Area: Metal Fabrication
Instructional Unit: Sheet Metal
LAP Title: Bending Flat Stock

Performance Objective: After completion of this LAP, you should be able to safely bend flat stock to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Perform bending of flat stock to specifications

Reference
1 - Wireman, Terry., Industrial Maintenance, Reston Publishing Co., 1983, Reston, VA

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sh-Metal # 7</td>
<td>Sh-Metal LAPs 1 - 6</td>
<td>2 Hours</td>
</tr>
<tr>
<td>Step</td>
<td>Action</td>
<td>Instructions</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>--------------</td>
</tr>
<tr>
<td>1.</td>
<td>READ</td>
<td>Job Sheet</td>
</tr>
<tr>
<td>2.</td>
<td>ENTER</td>
<td>Shop using SAFETY procedures</td>
</tr>
<tr>
<td>3.</td>
<td>GET</td>
<td>Materials and tools as listed on your Job sheet</td>
</tr>
<tr>
<td>4.</td>
<td>GO</td>
<td>To large table in the METAL FABRICATION AREA of the shop</td>
</tr>
<tr>
<td>5.</td>
<td>DO</td>
<td>Job sheet</td>
</tr>
<tr>
<td>6.</td>
<td>SIGNAL</td>
<td>Your INSPECTOR to check your completed work</td>
</tr>
<tr>
<td>7.</td>
<td>RETURN</td>
<td>All tools to their proper place in the tool room</td>
</tr>
<tr>
<td>8.</td>
<td>CLEAN</td>
<td>Up your work area</td>
</tr>
<tr>
<td>10.</td>
<td>GET</td>
<td>Your initial stamp and a ball peen hammer</td>
</tr>
<tr>
<td>11.</td>
<td>STAMP</td>
<td>Your initials on your cylinder</td>
</tr>
<tr>
<td>12.</td>
<td>RETURN</td>
<td>Your initial stamp and ball peen hammer</td>
</tr>
<tr>
<td>13.</td>
<td>GET</td>
<td>Sheet Metal LAP # 7</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET

Major Instructional Area: Metal Fabrication
Instructional Unit: Sheet Metal
LAP Title: 90 Degree Angle Iron W/Mitred Corner

Performance Objective: After completion of this LAP, you should be able to safely construct a 90 degree angle iron with a mitred corner. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task:

Construct 90 degree angle iron with a mitred corner

Reference:
3 - Zinigrabe, Claude J., Schumacher, Fred W., Sheet Metal Hand Processes, 1974, Delmar Publishers

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sh-Metal # 8</td>
<td>Sh-Metal LAPs 1 - 7</td>
<td>2 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
SHEET METAL
LAP # 8
CONSTRUCT 90 DEGREE ANGLE IRON WITH MITRED CORNER

1. GET Video tape "Sheet Metal Angle Iron Bender" located in cabinet # ___, slot # ____
2. VIEW Video tape
3. REWIND Video tape and reset counter
4. RETURN Video tape to cabinet
5. REVIEW Study sheets
6. READ Job sheet
7. ENTER Shop using SAFETY procedures
8. GET Materials and tools as listed on your Job sheet
9. GO To large table in the METAL FABRICATION AREA of the shop
10. DO Job sheet # 8
11. SIGNAL Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

12. RETURN All tools to their proper place in the tool room
13. CLEAN Up your work area
14. GET Your initial stamp and a ball peen hammer
15. STAMP Your initials on your angle iron/mitred corner
16. RETURN Your initial stamp and ball peen hammer
17. GET Sheet Metal LAP # 9
LEARNING ACTIVITY PACKET

Major Instructional Area       Metal Fabrication
Instructional Unit            Sheet Metal
LAP Title                     Bending a U-Bolt

Performance Objective         After completion of this LAP, you should be able to safely construct a U-bolt from 3/8" round stock to specifications. This knowledge will be demonstrated through a job sheet and a unit test with a minimum of 85% accuracy.

Task

Form a U-bolt from 3/8" round stock to specifications

Reference
3 - Zinngrabe, Claude J., Schumacher, Fred W., Sheet Metal Hand Processes, 1974, Delmar Publishers

LAP #     Prerequisites     Time Range
Sh-Metal # 9     Sh-Metal LAPs 1 - 8     2 Hours
LEARNING ACTIVITY PACKET GUIDE
SHEET METAL
LAP # 9
U-BOLT

1. GET  Video tape "Sheet Metal Forming A U-Bolt" located in cabinet # ___, slot # ___

2. VIEW  Video tape

3. REWIND  Video tape and reset counter

4. RETURN  Video to cabinet

5. REVIEW  Study sheet

6. READ  Job sheet

7. ENTER  Shop using SAFETY procedures

8. GET  Materials and tools as listed on your job sheet

9. GO  To the Hossfeld bender

10. DO  Job sheet # 9

11. SIGNAL  Your INSPECTOR to check your completed work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE ON WITH THIS LAP

12. RETURN  All tools to their proper place in the tool room

13. CLEAN  Up your work area

14. GET  Your initial stamp and a ball peen hammer

15. STAMP  Your initials on your U-bolt

16. RETURN  Your initial stamp and ball peen hammer

17. ASK  Your INSTRUCTOR for your next area of assignment
WARNING

- Do not touch electrically live parts or electrode with skin or wet clothing.
- Insulate yourself from work and ground.

ELECTRIC SHOCK can kill.

LAP # 0
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA    METAL FABRICATION

INSTRUCTIONAL UNIT        WELDING

LAP TITLE       INTRODUCTION AND SAFETY

PERFORMANCE OBJECTIVE    After completion of this LAP, you should be able to pass a welding safety test with 100% accuracy and perform metal identification. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS
Pass Safety Test with 100% accuracy
Perform metal identification spark test


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding # 0</td>
<td>None</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape
2. VIEW Video tape
3.REWIND Video tape and reset counter
4. REVIEW Study sheet
5. DO Assignment sheet (review tape if needed to complete)
6. CHECK Your answers to make sure they are correct
7. RETURN Video tape to cabinet
8. TAKE Safety Test
9. SIGNAL Your INSTRUCTOR to check your test

YOUR INSTRUCTOR WILL ASSIGN YOU TO OXY-ACETYLENE OR SHIELD METAL ARC
WELDING OXY-ACETYLENE

• Wear eye, ear and body protection.

ARC RAYS can burn.

FILLER ROD

FLAME INNER CONE

HEAT ENVELOPE

WELD BUDDLE

TORCH TIP

WELD BEAD

371

LAP # 0
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
METAL FABRICATION

INSTRUCTIONAL UNIT
WELDING OXY-ACETYLENE

LAP TITLE
SAFETY AND SETUP

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to pass a safety test with 100% accuracy and setup procedures for Oxy-acetylene Welding. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Pass Safety test with 100% accuracy and set-up for oxy-acetylene

REFERENCE
Hobart School of Welding. Oxyacetylene Welding, Cutting, and Brazing. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-OXY # 0</td>
<td>WELD-0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Oxyacetylene Welding, cutting and Brazing" from cabinet "A", slot # 32 *
2. VIEW "Intro to Oxyacetylene Applications" and "Safety and Health in Oxyacetylene Applications"
3. DO Assignment sheet
4. CHECK Your answers to make sure they are correct
5. TAKE Test
6. SIGNAL Your INSTRUCTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

7. RETURN W-OXY # 0 to the cabinet
8. GET W-OXY # 1 from the cabinet and continue
WELDING
OXY-ACETYLENE
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA: METAL FABRICATION

INSTRUCTIONAL UNIT: WELDING OXY-ACETYLENE

LAP TITLE: STRINGER BEADS

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to produce stringer beads in flat position with and without the use of filler metal. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Produce stringer beads in flat position with and without the use of a filler metal.

REFERENCE: Hobart School of Welding. Oxyacetylene Welding, Cutting, and Brazing. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-OXY # 1</td>
<td>WELD-0, W-OXY LAP # 0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Stringer Bead" from cabinet "A", slot # 32 *
2. VIEW Video tape from footage ___ through ___
3. REWIND Video tape and reset counter
4. COMPLETE Assignment sheet
5. CHECK Your work
6. RETURN Video tape to cabinet "A", slot # 32 *
7. READ Job sheet
8. ENTER Shop using SAFETY procedures
9. GET Equipment and materials needed
10. PRACTICE Skill needed to do Job sheet
11. DO Job sheet
12. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

13. RETURN All equipment and materials to their proper places
14. GET Initial stamps and a ball peen hammer
15. STAMP Your initials on the backside of your workpiece
16. PLACE Your workpiece in your locker
17. RETURN Initial stamps and ball peen hammer to tool room
18. CLEAN Your work area
19. RETURN W-OXY LAP # 1 to the cabinet
20. GET W-OXY LAP # 2 and continue
WELDING OXY-ACETYLENE

TACK WELDS

APPROX. 1" (25.4)

FIRE BRICKS

OAW

1/4
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA: METAL FABRICATION
INSTRUCTIONAL UNIT: WELDING OXY-ACETYLENE
LAP TITLE: LAP JOINT

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to produce quality lap joint fillet welds in flat position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Produce quality lap joint fillet welds in flat position

REFERENCE: Hobart School of Welding. Oxyacetylene Welding, Cutting, and Brazing. Troy, OH.

LAP # | Prerequisites | Time Range
--- | --- | ---
W-OXY # 2 | WELD-0, W-OXY # 0-1 | 3 Hours
LEARNING ACTIVITY PACKET GUIDE
METAL FABRICATION
WELDING – OXY-ACETYLENE LAP # 2
LAP JOINT

1. REVIEW Study sheet
2. DO Assignment sheet
3. CHECK Your answers to make sure they are correct
4. READ Job sheet
5. ENTER Shop using SAFETY procedures
6. GET Equipment and materials needed
7. PRACTICE Skill process for Job sheet
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF
YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN Equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. RETURN Initial stamps and ball peen hammer to the tool room
14. PLACE Your workpiece in your locker
15. CLEAN Your work area
16. RETURN W-OXY # 2 to the cabinet
17. GET W-OXY # 3 from the cabinet and continue
WELDING OXY-ACETYLENE

1/8" (3.2) SPACER

1/8" (3.2) ROOT OPENING

3/8"-1/2" (9.6-12.7)

1/4" (3.2) TACK WELDS

FIRE BRICKS

APPROX. 1' (25.4)

OAW

LAP # 3

380
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
METAL FABRICATION

INSTRUCTIONAL UNIT
WELDING OXY-ACETYLENE

LAP TITLE
BUTT JOINT

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to produce quality square groove weld on a butt joint in the flat position using the keyhole technique. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Produce quality square groove weld on a butt joint in the flat position using the keyhole technique

REFERENCE Hobart School of Welding. Oxyacetylene Welding, Cutting, and Brazing. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-OXY # 3</td>
<td>WELD-0, W-OXY #s 0-2</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

381
1. REVIEW       Study sheet
2. DO           Assignment sheet
3. CHECK        Your answers to make sure they are correct
4. READ         Job sheet
5. ENTER        Shop using SAFETY procedures
6. GET          Equipment and materials needed
7. PRACTICE     Skill for Job sheet
8. DO           Job sheet
9. SIGNAL       Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN      All equipment and materials to their proper places
11. GET         Initial stamps and a ball peen hammer
12. STAMP       Your initials on the backside of your workpiece
13. RETURN      Initial stamps and ball peen hammer
14. PLACE       Your workpiece in your locker
15. CLEAN       Your work area
16. RETURN      W-OXY # 3 to the cabinet
17. GET         W-OXY # 4 from the cabinet and continue
WELDING
OXY-ACETYLENE

TACK WELDS

35°-40°

FLUX

FLUX MUST COVER MOLTEN METAL

LAP # 4
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA: METAL FABRICATION

INSTRUCTIONAL UNIT: WELDING OXY-ACETYLENE

LAP TITLE: BRAZED BUTT JOINT

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to produce a quality brazed butt joint. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Produce a quality brazed butt joint

REFERENCE: Hobart School of Welding. Oxyacetylene Welding, Cutting, and Brazing. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-OXY # 4</td>
<td>WELD-0, W-OXY #s 0-3</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW Study sheet
2. DO Assignment sheet
3. CHECK Your answers to make sure they are correct
4. READ Job sheet
5. ENTER Shop using SAFETY procedures
6. GET Equipment and materials needed
7. PRACTICE Skill for Job sheet
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. RETURN Initial stamps and ball peen hammer
14. PLACE Your workpiece in your locker
15. CLEAN Your work area
16. RETURN W-OXY # 4 to the cabinet
17. GET W-OXY # 5 from the cabinet and continue
WELDING
OXY-ACETYLENE
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  METAL FABRICATION

INSTRUCTIONAL UNIT  WELDING OXY-ACETYLENE

LAP TITLE  BRAZED PIPE JOINT

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to produce a quality brazed pipe joint. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Produce a quality brazed pipe joint

REFERENCE  Hobart School of Welding. Oxyacetylene Welding, Cutting, and Brazing. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-OXY # 5</td>
<td>WELD-0, W-OXY #s 0-4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW Study sheet
2. DO Assignment sheet
3. CHECK Your answers to make sure they are correct
4. READ Job sheet
5. ENTER Shop using SAFETY procedures
6. GET Equipment and materials needed
7. PRACTICE Skill for Job sheet
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. RETURN Initial stamps and ball peen hammer
14. PLACE Your workpiece in your locker
15. CLEAN Your work area
16. RETURN W-OXY # 5 to the cabinet
17. GET W-OXY # 6 from the cabinet and continue
WELDING
OXY-ACETYLENE

HOLE
SQUARE
(25.4)
BEVEL

MAPP®
¼"-⅝"
(6.4-9.6)

1/16"-1/8" ACETYLENE
(1.6-3.2)

BURNED AREA

TORCH TIP
PLATE

90°

60°
SLAG

30°
PLATE

TORCH TIP

90°

TORCH TIP

BURNED AREA

LAP # 6
389
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA        METAL FABRICATION
INSTRUCTIONAL UNIT                WELDING OXY-ACETYLENE
LAP TITLE                        FLAME CUTTING

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to produce quality square bevel and circular flame cut edges. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Produce quality square bevel and circular flame cut edges

REFERENCE
Hobart School of Welding. Oxyacetylene Welding, Cutting, and Brazing. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-OXY # 6</td>
<td>WELD-0, W-Y #s 0-5</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
METAL FABRICATION
WELDING - OXY-ACETYLENE LAP # 6
FLAME CUTTING

1. REVIEW Study sheet
2. DO Assignment sheet
3. CHECK Your answers to make sure they are correct
4. READ Job sheet
5. ENTER Shop using SAFETY procedures
6. GET Equipment and materials needed
7. PRACTICE Skill for Job sheet
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. RETURN Initial stamps and ball peen hammer
14. PLACE Your workpiece in your locker
15. CLEAN Your work area
16. RETURN W-OXY # 6 to the cabinet
17. SEE Your INSTRUCTOR for your next area of assignment

391
WELDING
SHIELD METAL ARC

WELDING - MIG
METAL INERT GAS

WELDING - TIG
TUNGSTEN INERT GAS
WELDING
SHIELD METAL ARC

- Keep your head out of fumes.
- Use ventilation or exhaust to remove fumes from breathing zone.

FUMES AND GASES can be dangerous.
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA METAL FABRICATION

INSTRUCTIONAL UNIT WELDING - SHIELD METAL ARC

LAP TITLE SAFETY AND PROCEDURES

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to state SAFETY procedures and utilize simulator to practice angle, distance, and speed of the electrode in relationship to the workpiece. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS State SAFETY procedures

Utilize simulator to practice angle, distance, and speed of the electrode in relationship to the workpiece

REFERENCES Hobart School of Welding. Shielded Metal - Arc Welding. Troy, OH.


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-SMA # 0</td>
<td>WELD # 0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. **GET** Video tape "Shield Metal Arc Welding - 1" from cabinet "A", slot # 33 *
2. **VIEW** "Introduction to Shield Metal Arc Welding" and "Safety and Health of Welders"
3. **DO** Assignment sheet (you may need to view the tape again)
4. **CHECK** Your work
5. **RETURN** Video tape
6. **TAKE** Safety Test
7. **SIGNAL** Your INSTRUCTOR to check your work

**YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP**

8. **RETURN** W-SMA # 0 to the cabinet
9. **GET** W-SMA # 1 from the cabinet and continue
WELDING
SHIELD METAL ARC
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA METAL FABRICATION

INSTRUCTIONAL UNIT WELDING - SHIELD METAL ARC

LAP TITLE BUTTON BEADS

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to demonstrate the ability to; adjust machine settings, strike an arc, manipulate the electrode, and read the puddle to produce button beads. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS Demonstrate the ability to; adjust machine settings, strike an arc, manipulate the electrode, and read the puddle to produce button beads

REFERENCES Hobart School of Welding. Shielded Metal - Arc Welding. Troy, OH.


<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-SMA # 1</td>
<td>WELD - 0, W-SMA # 0</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "Shield Metal Arc Welding Basic" from cabinet "A", slot # 33 *

2. VIEW "Striking & Controlling the Arc in Flat Position"

3. DO Assignment sheet

4. CHECK Your work to make sure your answers are correct

5. REWIND Video tape and reset counter

6. RETURN Video tape to cabinet

7. DO Assignment sheet

8. CHECK Your answers to make sure they are correct

9. PRACTICE On simulator-running flat bead

10. CHECK When your score reaches the designated level—signal your INSPECTOR

11. GET Equipment to strike an arc

12. ENTER Welding booth and strike an arc

13. RETURN To classroom

14. GET Video tape "Shield Metal Arc Welding-1" from cabinet "A", slot # 32 *

15. VIEW "Pad of Beads in Flat Position & Crater Filling"

16. DO Assignment sheet

17. CHECK Your answers to make sure they are correct

18. ENTER Shop using SAFETY procedures

19. GET Equipment and materials needed

20. GO To welding booth

21. PRACTICE Making buttons

22. DO Job sheet
23. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

24. RETURN All equipment and materials to their proper places

25. CLEAN Your work area

26. RETURN W-SMA # 1 to the cabinet

27. GET W-SMA # 2 from the cabinet and continue
WELDING
SHIELD METAL ARC
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA METAL FABRICATION

INSTRUCTIONAL UNIT WELDING - SHIELD METAL ARC

LAP TITLE SHORT BEADS

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to produce short beads on flat surface. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS Produce short beads on flat surface

REFERENCES Hobart School of Welding. Shielded Metal - Arc Welding. Troy, OH.


LAP # Prerequisites Time Range
W-SMA # 2 WELD-0, W-SMA #s 0-1 3 Hours
LEARNING ACTIVITY PACKET GUIDE
METAL FABRICATION
WELDING SHIELD METAL ARC LAP # 2
SHORT BEADS

1. GET Video tape "W-SMA Basic-2" from cabinet "A", slot # 33 **
2. VIEW "Fillet Weld, LAP Joint, Horizontal Position"
3. REWIND Video tape and reset counter
4. DO Assignment sheet (you may need to view again)
5. RETURN Video tape to cabinet "A", slot # 33 **
6. REVIEW Job sheet
7. ENTER Shop using SAFETY procedures
8. PRACTICE Simulator until you reach designated level
9. SIGNAL Your INSPECTOR to check your work
   YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP
10. REVIEW Job sheet
11. GET Equipment and materials needed
12. ENTER Welding booth
13. PRACTICE Skill needed for Job sheet
14. DO Job sheet
15. SIGNAL Your INSPECTOR to check your work
   YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP
16. RETURN All equipment and materials to their proper places
17. CLEAN Your work area
18. RETURN W-SMA # 2 to cabinet
19. GET W-SMA # 3 from cabinet and continue

402

METAL FABRICATION WELDING-SHIELD METAL ARC LAP # 2
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          METAL FABRICATION

INSTRUCTIONAL UNIT               WELDING - SHIELD METAL ARC

LAP TITLE                         PAD OF BEADS

PERFORMANCE OBJECTIVE          After completion of this LAP, you should be able to produce a pad of beads in flat position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS          Produce a pad of beads in flat position

REFERENCES       Hobart School of Welding.  Shielded Metal - Arc Welding.  Troy, OH.
1. GET Video tape "W-SMA Basic-2" from cabinet "A", slot # 33 **
2. VIEW "Pad of Beads in Flat Position"
3. REWIND Video tape and reset counter
4. DO Assignment sheet (you may need to view again)
5. RETURN Video tape to cabinet "A", slot # 33 **
6. REVIEW Job sheet
7. ENTER Shop using SAFETY procedures
8. PRACTICE Simulator until you reach designated level
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. REVIEW Job sheet
11. GET Equipment and materials needed
12. ENTER Welding booth
13. PRACTICE Skill needed for Job sheet
14. DO Job sheet
15. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

16. RETURN All equipment and materials to their proper places
17. CLEAN Your work area
18. RETURN W-SMA # 3 to cabinet
19. GET W-SMA # 4 from cabinet and continue
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA METAL FABRICATION

INSTRUCTIONAL UNIT WELDING - SHIELD METAL ARC

LAP TITLE LAP JOINT

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to produce a fillet weld lap joint. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS Produce a fillet weld lap joint

REFERENCES Hobart School of Welding. Shielded Metal - Arc Welding. Troy, OH.


<table>
<thead>
<tr>
<th>LAP #</th>
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</thead>
<tbody>
<tr>
<td>W-SMA # 4</td>
<td>WELD-0, W-SMA #s 0-3</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "W-SMA Basic-2" from cabinet "A", slot # 34 *
2. VIEW "Fillet Weld, LAP Joint, Horizontal Position"
3. REWIND Video tape and reset counter
4. DO Assignment sheet (you may need to view again)
5. RETURN Video tape to cabinet "A", slot # 33 **
6. REVIEW Job sheet
7. ENTER Shop using SAFETY procedures
8. PRACTICE Simulator until you reach designated level
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. REVIEW Job sheet
11. GET Equipment and materials needed
12. ENTER Welding booth
13. PRACTICE Skill needed for Job sheet
14. DO Job sheet
15. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

16. RETURN All equipment and materials to their proper places
17. CLEAN Your work area
18. RETURN W-SMA # 4 to cabinet
19. GET W-SMA # 5 from cabinet and continue
WELDING
SHIELD METAL ARC

- SPACER WIRE
- TACK WELD

3/32" (2.4)
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM
LIBBEY SKILL CENTER, TOLEDO, OHIO
WELDING SHIELD METAL ARC LAP # 5

LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  METAL FABRICATION

INSTRUCTIONAL UNIT  WELDING - SHIELD METAL ARC

LAP TITLE  BUTT JOINT

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to Produce square groove butt joint in horizontal position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS  Produce square groove butt joint in horizontal position

REFERENCES  Hobart School of Welding. Shielded Metal - Arc Welding. Troy, OH.


<table>
<thead>
<tr>
<th>LAP #</th>
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</tr>
</thead>
<tbody>
<tr>
<td>W-SMA # 5</td>
<td>WELD-0, W-SMA #s 0-4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "W-SMA Basic-2" from cabinet "A", slot # 33 **
2. VIEW "Square Groove Weld, Butt Joint, Horizontal Position"
3. REWIND Video tape and reset counter
4. DO Assignment sheet (you may need to view again)
5. RETURN Video tape to cabinet "A", slot # 33 **
6. REVIEW Job sheet
7. ENTER Shop using SAFETY procedures
8. PRACTICE Simulator until you reach designated level
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. REVIEW Job sheet
11. GET Equipment and materials needed
12. ENTER Welding booth
13. PRACTICE Skill needed for Job sheet
14. DO Job sheet
15. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

16. RETURN All equipment and materials to their proper places
17. CLEAN Your work area
18. RETURN W-SMA # 5 to cabinet
19. GET W-SMA # 6 from cabinet and continue
WELDING
SHIELD METAL ARC
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
METAL FABRICATION

INSTRUCTIONAL UNIT
WELDING - SHIELD METAL ARC

LAP TITLE
TEE JOINT

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to produce fillet weld (3 bead) Tee joint in horizontal position and perform visual inspection. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS
Produce fillet weld (3 bead) Tee joint in horizontal position and perform visual inspection

REFERENCES
Hobart School of Welding. Shielded Metal - Arc Welding. Troy, OH.


<table>
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<tr>
<th>LAP #</th>
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<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-SMA # 6</td>
<td>WELD-0, W-SMA #s 0-5</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. GET Video tape "W-SMA Basic-2" from cabinet "A", slot # 33 **
2. VIEW "Fillet Weld, TEE Joint, Horizontal Position and Break Test"
3. REWIND Video tape and reset counter
4. DO Assignment sheet (you may need to view again)
5. RETURN Video tape to cabinet "A", slot # 33 **
6. REVIEW Job sheet
7. ENTER Shop using SAFETY procedures
8. PRACTICE Simulator until you reach designated level
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. REVIEW Job sheet
11. GET Equipment and materials needed
12. ENTER Welding booth
13. PRACTICE Skill needed for Job sheet
14. DO Job sheet
15. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

16. RETURN All equipment and materials to their proper places
17. CLEAN Your work area
18. RETURN W-SMA # 6 to cabinet
19. GET W-OXY # 0, if you have completed this area also, then get LAP W-MIG # 0
WELDING - MIG METAL INERT GAS

WARNING

- Disconnect input power by removing plug from receptacle before working inside SP-100.
- Use only grounded receptacle.
- Do not touch electrically “hot” parts inside SP-100.

ELECTRIC SHOCK can kill.
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA METAL FABRICATION

INSTRUCTIONAL UNIT WELDING - METAL INERT GAS

LAP TITLE SAFETY AND PROCEDURES

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to state SAFETY rules and procedures, demonstrate equipment setting, and practice on simulator feed, speed, and angle. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS State SAFETY rules and procedures, demonstrate equipment setting, and practice on simulator feed, speed, and angle

REFERENCES

Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.
1. GET Video tape "Introduction to MIG" from cabinet "A", slot # 31 **
2. VIEW Video tape
3. REWIND Video tape and reset counter
4. DO Assignment sheet
5. CHECK Your answers to make sure they are correct
6. RETURN Video tape to cabinet "A", slot # 31 **
7. TAKE Safety Test
8. ENTER Shop using SAFETY procedures
9. PRACTICE On simulator until designated competency has been reached
10. CHECK When your score has reached designated level signal your INSPECTOR
11. RETURN W-MIG # 1 to cabinet
12. GET W-MIG # 2 from cabinet and continue
WELDING - MIG
METAL INERT GAS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          METAL FABRICATION

INSTRUCTIONAL UNIT                WELDING - METAL INERT GAS

LAP TITLE                      BUTTON BEADS

PERFORMANCE OBJECTIVE     After completion of this LAP, you should be able to produce button beads in flat position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK                           Produce button beads in flat position

REFERENCES

Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-MIG # 1</td>
<td>WELD-0, OXY, ARC LAPs</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW  Job sheet
2. ENTER  Shop using SAFETY procedures
3. PRACTICE  Simulator until designated level is reached
4. SIGNAL  Your INSTRUCTOR to check your work
5. GET  Equipment and materials needed
6. ENTER  Welding booth
7. PRACTICE  Button beads
8. DO  Job sheet
9. SIGNAL  Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN  All equipment and materials to their proper places
11. GET  Initial stamps and a ball peen hammer
12. STAMP  Your initials on the backside of your workpiece
13. PLACE  Your workpiece in your locker
14. RETURN  Initial stamps and ball peen hammer
15. CLEAN  Your work area
16. GET  W-MIG # 2 from the cabinet and continue
WELDING - MIG
METAL INERT GAS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
METAL FABRICATION

INSTRUCTIONAL UNIT
WELDING - METAL INERT GAS

LAP TITLE
SHORT BEADS

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to produce quality short beads in flat position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Produce quality short beads in flat position

REFERENCES

Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

LAP #
W-MIG # 2

Prerequisites
WELD-0, OXY, ARC LAPs

Time Range
3 Hours
LEARNING ACTIVITY PACKET GUIDE
METAL FABRICATION
WELDING - MIG LAP # 2
SHORT BEADS

1. REVIEW Job sheet
2. ENTER Shop using SAFETY procedures
3. PRACTICE Simulator until designated level is reached
4. SIGNAL Your INSTRUCTOR to check your work
5. GET Equipment and materials needed
6. ENTER Welding booth
7. PRACTICE Button beads
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF
YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. PLACE Your workpiece in your locker
14. RETURN Initial stamps and ball peen hammer
15. CLEAN Your work area
16. GET W-MIG # 3 from the cabinet and continue
WELDING - MIG
METAL INERT GAS
INDUSTRIAL AUTOMATION MAINTENANCE MECHANICS PROGRAM  
LIBBEY SKILL CENTER, TOLEDO, OHIO 
WELDING - MIG LAP # 3 

LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA METAL FABRICATION

INSTRUCTIONAL UNIT WELDING - METAL INERT GAS

LAP TITLE OUTSIDE CORNER JOINT

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to produce quality outside corner joint in flat position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Produce quality outside corner joint in flat position

REFERENCES

Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
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<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-MIG # 3</td>
<td>WELD-0, OXY, ARC L.APs</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW Job sheet
2. ENTER Shop using SAFETY procedures
3. PRACTICE Simulator until designated level is reached
4. SIGNAL Your INSTRUCTOR to check your work
5. GET Equipment and materials needed
6. ENTER Welding booth
7. PRACTICE Button beads
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. PLACE Your workpiece in your locker
14. RETURN Initial stamps and ball peen hammer
15. CLEAN Your work area
16. GET W-MIG # 4 from the cabinet and continue
WELDING - MIG
METAL INERT GAS

ROOT

FACE

3/8" (9.5)
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA        METAL FABRICATION

INSTRUCTIONAL UNIT                WELDING - METAL INERT GAS

LAP TITLE                         LAP JOINT

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to produce quality lap joint in flat position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Produce quality lap joint in flat position

REFERENCES

Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

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<tbody>
<tr>
<td>W-MIG # 4</td>
<td>WELD-0, OXY, ARC LAPs</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW  Job sheet
2. ENTER  Shop using SAFETY procedures
3. PRACTICE  Simulator until designated level is reached
4. SIGNAL  Your INSTRUCTOR to check your work
5. GET  Equipment and materials needed
6. ENTER  Welding booth
7. PRACTICE  Button beads
8. DO  Job sheet
9. SIGNAL  Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN  All equipment and materials to their proper places
11. GET  Initial stamps and a ball peen hammer
12. STAMP  Your initials on the backside of your workpiece
13. PLACE  Your workpiece in your locker
14. RETURN  Initial stamps and ball peen hammer
15. CLEAN  Your work area
16. GET  W-MIG # 5 from the cabinet and continue
WELDING – MIG
METAL INERT GAS

ROOT PÉNÉTRATION FLUSH

FACE SLIGHTLY CONCAVE
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          METAL FABRICATION
INSTRUCTIONAL UNIT                  WELDING - METAL INERT GAS
LAP TITLE                            BUTT JOINT

PERFORMANCE OBJECTIVE After completion of this LAP, you should be able to produce quality butt joint in flat position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK Produce quality butt joint in flat position

REFERENCES

Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

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<tbody>
<tr>
<td>W-MIG # 5</td>
<td>WELD-0, OXY, ARC LAPs</td>
<td>3 Hours</td>
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</table>

431
LEARNING ACTIVITY PACK\textbullet\textcircled{G}UIDE
METAL FABRICATION
WELDING - MIG LAP # 5
BUTT JOINT

1. REVIEW  Job sheet  
2. ENTER  Shop using SAFETY procedures  
3. PRACTICE  Simulator until designated level is reached  
4. SIGNAL  Your INSTRUCTOR to check your work  
5. GET  Equipment and materials needed  
6. ENTER  Welding booth  
7. PRACTICE  Button beads  
8. DO  Job sheet  
9. SIGNAL  Your INSPECTOR to check your work  

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN  All equipment and materials to their proper places  
11. GET  Initial stamps and a ball peen hammer  
12. STAMP  Your initials on the backside of your workpiece  
13. PLACE  Your workpiece in your locker  
14. RETURN  Initial stamps and ball peen hammer  
15. CLEAN  Your work area  
16. GET  W-MIG # 6 from the cabinet and continue
WELDING - MIG
METAL INERT GAS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA: METAL FABRICATION

INSTRUCTIONAL UNIT: WELDING - METAL INERT GAS

LAP TITLE: TEE JOINT

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to produce quality tee joint in flat position. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Produce quality tee joint in flat position

REFERENCES:

Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

<table>
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<tbody>
<tr>
<td>W-MIG # 6</td>
<td>WELD-0, OXY, ARC LAPs</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW  Job sheet
2. ENTER  Shop using SAFETY procedures
3. PRACTICE  Simulator until designated level is reached
4. SIGNAL  Your INSTRUCTOR to check your work
5. GET  Equipment and materials needed
6. ENTER  Welding booth
7. PRACTICE  Button beads
8. DO  Job sheet
9. SIGNAL  Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN  All equipment and materials to their proper places
11. GET  Initial stamps and a bail peen hammer
12. STAMP  Your initials on the backside of your workpiece
13. PLACE  Your workpiece in your locker
14. RETURN  Initial stamps and ball peen hammer
15. CLEAN  Your work area
16. GET  W-TIG # 0 from the cabinet and continue
WELDING - TIG
TUNGSTEN INERT GAS

• Keep flammable material away.
• Do not weld upon containers which have held combustibles.

WELDING SPARKS can cause fire or explosion.
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  METAL FABRICATION

INSTRUCTIONAL UNIT  WELDING - TUNGSTEN INERT GAS

LAP TITLE  SAFETY AND PROCEDURES

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to state SAFETY rules and set-up procedure and practice on simulator for feed, speed, and angle. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASKS  State SAFETY rules and set-up procedure and practice on simulator for feed, speed, and angle


Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-TIG # 0</td>
<td>WELD-0, W-MIG LAPs</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
LEARNING ACTIVITY PACKET GUIDE
METAL FABRICATION
WELDING - TIG LAP # 0
SAFETY AND PROCEDURES

1. GET Video tape "Introduction to TIG" from cabinet "A", slot # 31 *
2. VIEW Video tape
3. REWIND Video tape and reset counter
4. REVIEW Study sheet
5. DO Assignment sheet
6. CHECK Your answers to make that they are correct
7. RETURN Video tape to cabinet "A", slot # 31 *
8. TAKE Safety Test
9. SIGNAL Your INSTRUCTOR to check your test
10. REVIEW Study sheets on simulator
11. ENTER Shop using SAFETY procedures
12. PRACTICE On simulator until designated competency has been reached
13. SIGNAL Your INSPECTOR when your scores have reached designated level
14. RETURN All equipment and materials to their proper places
15. GET W-TIG # 1 from cabinet and continue
WELDING - TIG
TUNGSTEN INERT GAS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  METAL FABRICATION
INSTRUCTIONAL UNIT  WELDING - TUNGSTEN INERT GAS
LAP TITLE  SHORT BEADS

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to produce short beads in flat position on aluminum stock. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Produce short beads in flat position on aluminum stock


Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

LAP #  Prerequisites  Time Range
W-TIG # 1  TIG # 0 LAP  3 Hours
LEARN ACTIVITY PACKET GUIDE
METAL FABRICATION
WELDING - TIG LAP # 1
SHORT BEADS

1. REVIEW Job sheet
2. ENTER Shop using SAFETY procedures
3. PRACTICE Simulator until designated level is reached
4. SIGNAL Your INSTRUCTOR to check your work
5. GET Equipment and materials needed
6. ENTER Welding booth
7. PRACTICE Button beads
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF
YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. PLACE Your workpiece in your locker
14. RETURN Initial stamps and ball peen hammer
15. CLEAN Your work area
16. GET W-TIG # 2 from the cabinet and continue
WELDING - TIG
TUNGSTEN INERT GAS

TACK WELD

FILLER ROD MOTION

PUSH

LAP # 2
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA
METAL FABRICATION

INSTRUCTIONAL UNIT
WELDING - TUNGSTEN INERT GAS

LAP TITLE
OUTSIDE CORNER JOINT

PERFORMANCE OBJECTIVE
After completion of this LAP, you should be able to produce outside corner joint in flat position on aluminum stock. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK
Produce outside corner joint in flat position on aluminum stock

REFERENCES
Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

LAP #     Prerequisites     Time Range
W-TIG # 2  W-MIG #s 0-1     3 Hours
LEARNING ACTIVITY PACKET GUIDE
METAL FABRICATION
WELDING - TIG LAP # 2
OUTSIDE CORNER JOINT

1. REVIEW Job sheet
2. ENTER Shop using SAFETY procedures
3. PRACTICE Simulator until designated level is reached
4. SIGNAL Your INSTRUCTOR to check your work
5. GET Equipment and materials needed
6. ENTER Welding booth
7. PRACTICE Button beads
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. PLACE Your workpiece in your locker
14. RETURN Initial stamps and ball peen hammer
15. CLEAN Your work area
16. GET W-TIG # 3 from the cabinet and continue
WELDING - TIG
TUNGSTEN INERT GAS

TACK WELDS

1/8" (3.2)

80°-85°
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA: METAL FABRICATION
INSTRUCTIONAL UNIT: WELDING - TUNGSTEN INERT GAS
LAP TITLE: LAP JOINT

PERFORMANCE OBJECTIVE: After completion of this LAP, you should be able to produce lap joint in flat position on aluminum stock. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK: Produce lap joint in flat position on aluminum stock

REFERENCES:
- Hobart School of Welding Technology. *Gas Tungsten Arc Welding*. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
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</tr>
</thead>
<tbody>
<tr>
<td>W-TIG # 3</td>
<td>W-MIG #s 0-2</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW Job sheet
2. ENTER Shop using SAFETY procedures
3. PRACTICE Simulator until designated level is reached
4. SIGNAL Your INSTRUCTOR to check your work
5. GET Equipment and materials needed
6. ENTER Welding booth
7. PRACTICE Button beads
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP
10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. PLACE Your workpiece in your locker
14. RETURN Initial stamps and ball peen hammer
15. CLEAN Your work area
16. GET W-TIG # 4 from the cabinet and continue
WELDING - TIG
TUNGSTEN INERT GAS
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA  METAL FABRICATION

INSTRUCTIONAL UNIT  WELDING - TUNGSTEN INERT GAS

LAP TITLE  BUTT JOINT

PERFORMANCE OBJECTIVE  After completion of this LAP, you should be able to produce butt joint in flat position on aluminum stock. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK  Produce butt joint in flat position on aluminum stock

REFERENCES


Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

<table>
<thead>
<tr>
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<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-TIG # 4</td>
<td>W-MIG #s 0-3</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW Job sheet
2. ENTER Shop using SAFETY procedures
3. PRACTICE Simulator until designated level is reached
4. SIGNAL Your INSTRUCTOR to check your work
5. GET Equipment and materials needed
6. ENTER Welding booth
7. PRACTICE Button beads
8. DO Job sheet
9. SIGNAL Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN All equipment and materials to their proper places
11. GET Initial stamps and a ball peen hammer
12. STAMP Your initials on the backside of your workpiece
13. PLACE Your workpiece in your locker
14. RETURN Initial stamps and ball peen hammer
15. CLEAN Your work area
16. GET W-TIG # 5 from the cabinet and continue
WELDING – TIG
TUNGSTEN INERT GAS

E70S-3

TACK WELDS

1C"
LEARNING ACTIVITY PACKET

MAJOR INSTRUCTIONAL AREA          METAL FABRICATION

INSTRUCTIONAL UNIT                  WELDING - TUNGSTEN INERT GAS

LAP TITLE                           TEE JOINT

PERFORMANCE OBJECTIVE

After completion of this LAP, you should be able to produce tee joint in flat position on aluminum stock. This knowledge will be demonstrated through a study sheet, an assignment sheet, a job sheet, and a unit test with a minimum of 85% accuracy.

TASK

Produce tee joint in flat position on aluminum stock

REFERENCES


Hobart School of Welding Technology. Gas Tungsten Arc Welding. Troy, OH.

<table>
<thead>
<tr>
<th>LAP #</th>
<th>Prerequisites</th>
<th>Time Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-TIG # 5</td>
<td>W-MIG #s 0-4</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
1. REVIEW  Job sheet
2. ENTER  Shop using SAFETY procedures
3. PRACTICE  Simulator until designated level is reached
4. SIGNAL  Your INSTRUCTOR to check your work
5. GET  Equipment and materials needed
6. ENTER  Welding booth
7. PRACTICE  Button beads
8. DO  Job sheet
9. SIGNAL  Your INSPECTOR to check your work

YOUR INSTRUCTOR WILL GIVE YOU SPECIFIC INSTRUCTIONS IF YOU NEED TO CONTINUE WITH THIS LAP

10. RETURN  All equipment and materials to their proper places
11. GET  Initial stamps and a ball peen hammer
12. STAMP  Your initials on the backside of your workpiece
13. PLACE  Your workpiece in your locker
14. RETURN  Initial stamps and ball peen hammer
15. CLEAN  Your work area
16. GIVE  Yourself a hand for finishing