



NATIONAL OPEN UNIVERSITY OF NIGERIA

FACULTY OF AGRICULTURAL
SCIENCES

DEPARTMENT OF CROP & SOIL
SCIENCE

FPY/SIWES PRACTICAL GUIDE

**AGM 403:
WORKSHOP PRACTICES**

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FACULTY OF AGRICULTURAL SCIENCES

400 LEVEL (FPY/SIWES) PRACTICAL GUIDE

AGM 403: WORKSHOP PRACTICE (2UNITS)

THE WORKSHOP PRACTICE PRACTICAL

METAL BENCH WORK PRODUCTION

1.0 Introduction

Workshop is a place where students acquire knowledge on the operation of various processes involved in manufacturing and production. The **Workshop Practice** course makes students competent in handling **practical** work in engineering environment. 'Workshop practice' is a method, a set of rules, a ritual, a set of guidelines or whatever another similar superlative/s you wish to apply.

The purpose is to ensure a repeatable and professional approach to the work, and hopefully its result. WHILE the theory of workshop practices is to familiarise the pupil with the numerous sorts of approaches and how they utilised interior the generating of things. Workshop practices will contain using hand approaches at the same time with observed, a document, ruler, scribe, protractor, hammer, chisel etc. each and every device has its particular objective. in case you pick to accomplish a job, you are able to desire to be attentive to which device and which craftsman you are able to hire to do a undeniable job. in addition, there are machines like a lathe, milling device, drill, grinder, planer, welding device etc....all have their very own particular good factors that carry out initiatives that are necessary interior the generating technique. Having understood a thank you to make something is purely a million/2 the story...to make it and make some money as properly is somewhat considerable because of the fact having made your first widget and purchased tens of millions the worldwide

will desire the main modern-day widget and that desires analyze, and layout and production skills as quickly as extra.

Introductory Agricultural Workshop Practice is a formal instruction in the science that deals with basic application of Workshop Practice in agriculture in organised institutions of learning.

These materials are not mandatory. They provide advice and guidance on approaches to delivering and assessing the BENCH WORK (Workshop practice) Practical. They are intended for technicians and students who are delivering this Practical. They should be read in conjunction with:

1. the Practical Specification
2. the Course Specification
3. the Added Value Practical Specification
4. the Course Material
5. appropriate assessment support materials

2.0 Objectives

The main objective of acquiring Workshop Practice knowledge is to help in solving practical agricultural problems. Specific objectives of Agricultural Workshop Practice are:

1. Is an essential aspect of our educational set up
2. it educates youths on the impact and opportunity in the Workshop Practice and agro-business.
3. It also exposes them to vast store of knowledge available for anyone contemplating owning or managing a

The main aim of this Practical, as stated in the Practical Specification, is for students to develop practical skills in the use of Bench work tools. Students will learn to read and follow simple metal sheet drawings or diagrams. Students will also develop their knowledge and understanding of metal materials, recycling and sustainability issues, as well as an appreciation of safe working practices in the workshop.

This Practical will also give students the opportunity to develop thinking skills and skills in numeracy, employability, enterprise and citizenship.

3.0 PROCEDURE FOR CONDUCT OF PRACTICAL

This Practical can be delivered as:

- a stand-alone Practical
- part of the Workshop Practice Practical guide

Progression into this Practical

Entry into this Course is at the discretion of the Faculty. However, students would normally be expected to have attained useful skills, knowledge and understanding from prior learning.

Students may have also gained relevant skills and knowledge through other prior learning, life and work experiences.

Skills, knowledge and understanding covered in this Practical

Information about skills, knowledge and understanding is given in the Workshop practice Course Material.

The Practical is being delivered as part of the Workshop practice Course.

The Practical is also being delivered on a free-standing basis; lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their Faculty.

Approaches to learning and teaching

1. General advice

The Practical is designed to provide flexibility and choice for both the learner and the teacher.

The Workshop Practice Course Material provide broad guidance on approaches to learning and teaching which may apply to all Practical's of the Course.

Learning and teaching activities should be designed to stimulate students' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated Assessment

Standards. Learning should be supported by appropriate practical activities, so that skills are developed simultaneously with knowledge and understanding.

When delivering the Practical as part of the Workshop Practice Course, reference should be made to the appropriate content statements within the syllabus.

‘Further mandatory information on Course coverage’ section of the Added Value Practical Specification to ensure the required breadth of knowledge is covered.

2. Health and safety

Each Faculty already has its statutory obligations and local advice on health and safety practice. In addition, it is likely that Faculty will have policies and approaches to learning and teaching which support best practice in the workshop environment.

Students should be reminded of the importance and expectations of responsible working and the care and welfare of self and others. In addition, most students will already be aware and have previous experience of workshop and practical environments and there will be opportunities to visit these responsibilities throughout the Practical.

Faculty is likely to consider the students’ positive attitudes to safety, care and attention, through observation of students’ working procedures, responsible use of tools, conversations, simple question and answer, and other opportunities to providing evidence.

Proper care of tools and recognition of the dangers of tool defects with regard to quality of work and possible hazards will be a recurrent theme in the Course, and the topic should be raised in this Practical.

Advice specific to delivery of this Practical

Learning and teaching approaches for this Practical will take a variety of forms. Teaching will certainly include whole class demonstration and instruction as well as follow up sessions with individual students or

small groups. Students may demonstrate a range of preferences for learning and these will be teased out over the period of the Course.

Practical demonstrations of bench work techniques can be followed up by close supervision and one-to-one assistance, where required.

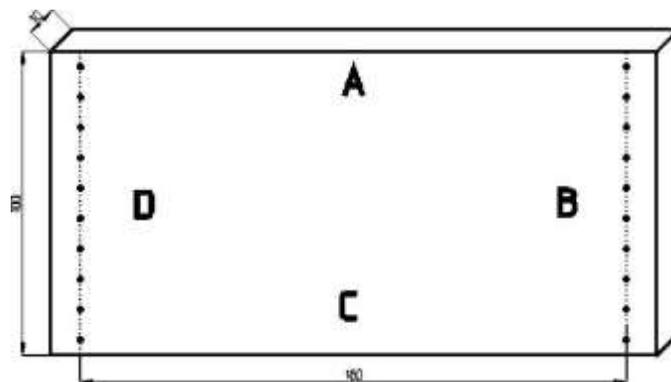
For each practical exercise, students should be shown a completed example of the work to be undertaken, enabling them to see the standard of work they are expected to produce. It would assist students at this level if orthographic and pictorial views were provided together to allow for easier visualisation of an item.

Knowledge and understanding

Knowledge and understanding should not be taught in isolation from other aspects of the Course. Practical examples should be used where possible, for example, when learning which tools and materials are associated with different jointing techniques, this should be related to other work being undertaken in the Practical.

Work practice 1.0

Metal Plate – Working Step No. 1



MATERIALS:

1. 1-piece flat bar 200 mm × 102 mm × 10 mm
2. steel rule 400 mm
3. scribe
4. center punch
5. hammer 200 g

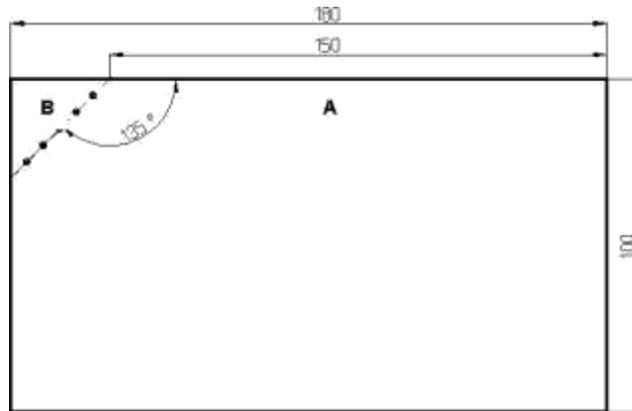
6. protractor
7. try square
8. combination square
9. vernier caliber 250 mm
10. depth vernier caliber
11. hand hacksaw
12. flat file 250 mm rough and bastard
13. triangular file 250 mm rough and bastard
14. different twist drills
15. different screw taps
16. different countersink
17. letter stamps
18. chisel

Procedures

1. Take a piece of flat bar with a measurement of 200 mm lengths and 105 mm width and 10 mm thickness.
2. Take the letter “A” stamp and stamp it as shown in the above drawing.
3. File surface of edge A even and remove all rust and forging scale. First use a rough file, then for finishing the surface a bastard file. Control the evenness with the try square.
4. Layout lines from the left side as well as on the right side. Use edge A as a reference to put the try square and scribe the lines.
5. Center punch the lines with at least 5 mm distance between the marking points.
6. Cut on the outer part of the lines using the hand hacksaw and leave at least 1mm allowance for filing.
7. File the surfaces of edges B and D in a right angle to surface A. File the 1mm excess to the size required.

8. File surface of edge C even and parallel to edge A to the size required. First use a rough file, then for finishing the surface a bastard file.

WORK PRACTICE NO.2.0



Procedure

1. Take a combination square and set 135 degrees angle using a protractor.
2. Put the combination square at edge A.
3. Scribe a line with the scriber.
4. Center punch the line with at least 5 mm distance between the marking points.
5. Cut on the outer part of the line using the hand hacksaw and leave at least 1mm allowance for filing.
6. File the surface of edge B in an angle of 135 ° to surface A. File the 1mm excess to the size required.

4.0 CONCLUSION

The Practical was designed to provide flexibility and choice for both the learner and the teacher.

The Workshop Practice Course Material will provide broad guidance on approaches to learning and teaching which may apply to all Practical's of the Course.

Learning and teaching activities should has been designed to stimulate students' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated

Assessment Standards. Learning should be supported by appropriate practical activities, so that skills are developed simultaneously with knowledge and understanding.

When delivering the Practical as part of the Workshop Practice Course, reference was made to the appropriate content statements within the syllabus.

'Further mandatory information on Course coverage' section of the Added Value Practical Specification to ensure the required breadth of knowledge is covered.

5.0 REFERENCE

1. Kwesi A. Workshop Theory and Practice. Nigeria. Faps Print. 2005
2. Atkins, E. A. Workshop Practice. Isaac Pitman.
3. Rajput R. K. Workshop Practice Laxmi Publications. 2009
4. Adeogun R., Toriola J. 2006. Workshop Theory and Practice. Twenty Publishers. Nigeria
5. Taiwo A., Jekayinfa S. O., Onawumi A.S. Mechanical Maintenance and Repairs. Orsome Publishers. Nigeria.

CARPENTRY BENCH WORK:

1.0 Introduction

These materials are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Practical Bench work: Flat Frame Construction (Workshop practice) Practical. They are intended for technicians and students who are delivering this Practical. They should be read in conjunction with:

- a. the Practical Specification
- b. the Course Specification

- c. the Added Value Practical Specification
- d. the Course Material
- e. appropriate assessment support materials

2.0 Objective

The main aim of this Practical, as stated in the Practical Specification, is for students to develop practical skills in the use of bench work tools and the production of basic flat-frame bench work joints and assemblies. Students will learn to read and follow simple bench work drawings or diagrams. Students will also develop their knowledge and understanding of bench work materials, recycling and sustainability issues, as well as an appreciation of safe working practices in the workshop.

This Practical will also give students the opportunity to develop thinking skills and skills in numeracy, employability, enterprise and citizenship.

3.0 Procedure For Conduct Of Practical

MATERIAL

1. Carpenter's steel square.
2. Try-square, rosewood handle faced with brass, steel blade.
3. Small steel square for testing fine work.
4. Sliding T-bevel, for marking or testing other than a square angle.
5. Bench-knife; at a, round taper-point for scratching; at b, a knife-edge.
6. [Marking-gauge](#): a, the bar; b, the head.
7. Spring compasses.
8. Plumb-bob and line.
9. Spirit-level: a for horizontal, b for vertical surfaces.
10. Bench-vise: a, bench-screw.
11. Bench-stop of hard maple, about two inches square.
12. Pine bench-hook.
13. Iron bench-dog.
14. Iron clamp.

15. Hand-screw.
16. Oil-stone.
17. Oil-slip.
18. Oil-can.
19. Miter-box with one side projecting to catch against the bench-top.
20. Glue-pot: a, for the water; b, for the glue.
21. Rip-saw and cross-cut, apple-[wood](#) or beech handles and steel blades.
22. Compass-saw.
23. Back-saw, a very thin blade stiffened by an iron or brass back. Also called tenon-saw.
24. Frame-saw.
25. Float, like a saw, but with wide teeth.
26. Chisel, with apple-wood or hickory handle, a bevel side, and a flat side or face.
27. Gouge, the face is the hollow side.
28. [Jack-plane](#):
29. Cap.
30. Wedge.
31. Smoothing-plane.

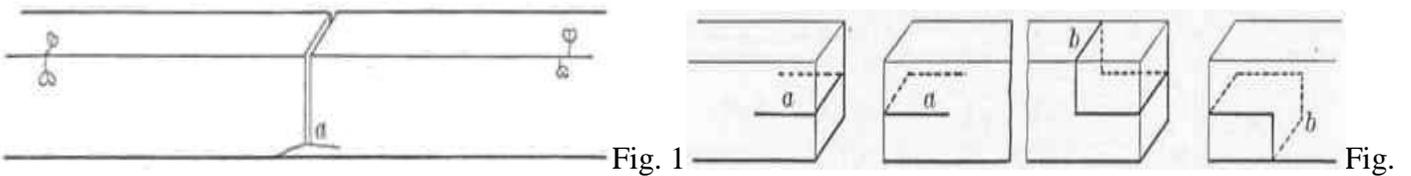
Work practice 1.0: Construction of A Half-Joint

Material. - Stick of sawed pine, 3" square and 4" long.

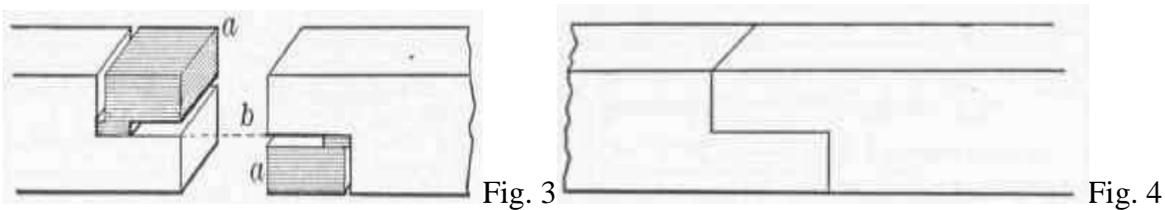
PROCEDURE. - To lay out and make a [half-joint](#).

1. Plane the stick to exactly 2 3/4" square, and mark the face-edge. Saw into two equal lengths after [marking](#) with the try-square and knife. When near the finish of the saw-cut, support the ends to prevent the stick from breaking, as shown at a, Fig. 1.
2. Set the [marking-gauge](#) to 1 3/8"; mark on the ends just cut and along the sides 2 3/4", keeping the head of the gauge always on the face of the piece. These gauge-marks may be made without turning the pieces over, but allowing them to remain on the bench, face up, as shown in a, a, Fig. 2.
3. Now mark with the try-square and knife 2 3/4" from the end, above the gauge-mark on one piece, and below the gauge-mark on the other, as at b, b, Fig. 2, always adjusting the handle of the try-square to the face of the stick.

4. The parts to be removed, shaded a, a, in Fig. 3, are now sawed out, using the rip-saw first and the cross-cut to finish. These parts, which are waste pieces, must contain the saw-kerfs, as shown in Fig. 3.
5. If the gauge and try-square have been properly adjusted to the face of the pieces, and the saw-kerfs accurately kept in the waste [wood](#), the sticks will fit together, as shown in Fig. 4, so as to make the face even, or flush.
6. If the saws have not cut accurately, trim down carefully to the gauge and square-marks with the chisel.
7. Fig. 5 shows the pieces placed at right angles, in which position they should fit as well as in Fig. 4.
8. The same method of marking and cutting is employed to make the scarf-joints, of which Figs. 6, 7, and 8 are examples. In the joint (Fig. 8) the pieces are forced together by the key a, which is slightly wedge-shaped.
9. The joints (Figs. 9 and 10) used in building trusses may be made entirely with the saws, or with the saws and chisel. In practice, one piece of such joints is marked and cut first, laid in proper position on the other, which is then marked from the first.



2



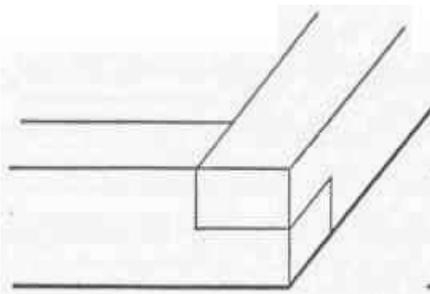


Fig. 5

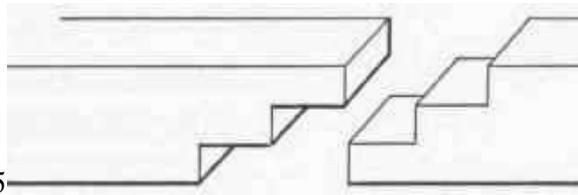


Fig. 6

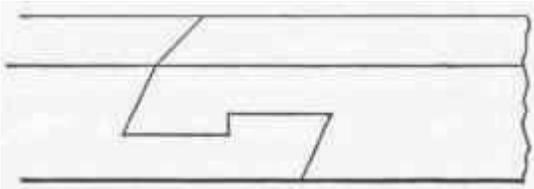


Fig. 7

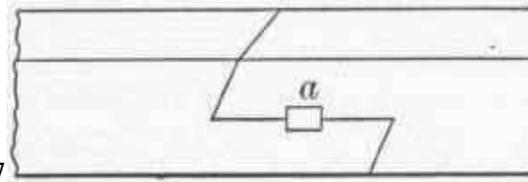


Fig. 8

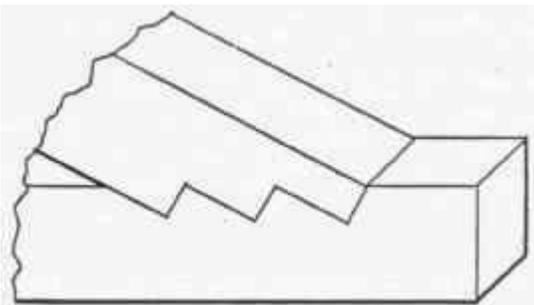


Fig. 9

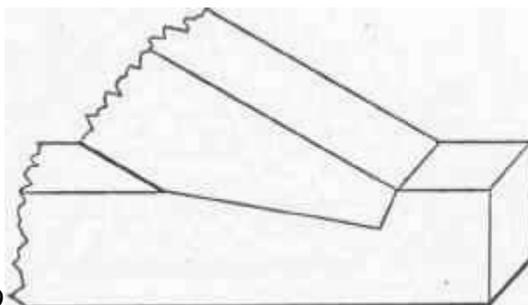


Fig. 10

WORK PRACTICE NO 2.0 - Construction Of A Mortise-Joint

Materials. - The sticks of work practice 3.0 after cutting off the [half-joint](#). Work. - To unite the pieces with a through mortise-joint.

PROCEDURE

1. Hold the pieces in the position shown in Fig. 1, with the faces toward you. The upper is to have a tenon formed on its end, and the lower a mortise cut into it.
2. Adjust the upper piece 2" from the end of the lower; mark with a sharp pencil the width of the upper piece on the face-edge of the lower (a, a, Fig. 1). With these points as guides, mark with the try-square and pencil on three sides of the mortise-piece, as shown at a, a, Fig. 2; and with the try-square and knife, mark all around the tenon-piece 3 1/4" from its end, as at b, b.

3. Set the gauge at $\frac{7}{8}$ " , and mark on the end and sides of the tenon-piece, and on the top and bottom of the mortise-piece, as at a, a, Fig. 3. Then set the gauge at $1\frac{7}{8}$ " and mark between the same limits as before, producing the lines b, b, Fig. 4. Now place the tenon-piece on the mortise-piece, and note that the marks correspond exactly.
4. Saw the tenon, observing the instructions in Exercise 9, in regard to the saw-kerf and waste [wood](#). In order to enter the mortise, the tenon (a, Fig. 5) must have its edges removed by chamfering, as at b; the [measures](#), shown at c, Fig. 5, are marked with the pencil and rule, and the chamfer cut with the chisel.
5. To cut out the mortise, bore with the brace and $\frac{7}{8}$ " center-bit two holes in the mortise-piece, as at a, a, Fig. 6, about one half way through; then turn the piece over and bore down to meet the first holes. With the chisel and mallet, remove the part b between the holes, cutting first one side then the other with the edge of the chisel, parallel to the grain, c, and with the bevel side down, so as to throw out the chips. Next turn the chisel, and cut down the ends of the mortise as at d, leaving a margin of wood for finishing.
6. The mortise is now fitted for the tenon by cutting away the margin (a, a, Fig. 7) and paring the sides until the tenon passes snugly through. Test the sides of the mortise for flatness with the blade of the try-square..

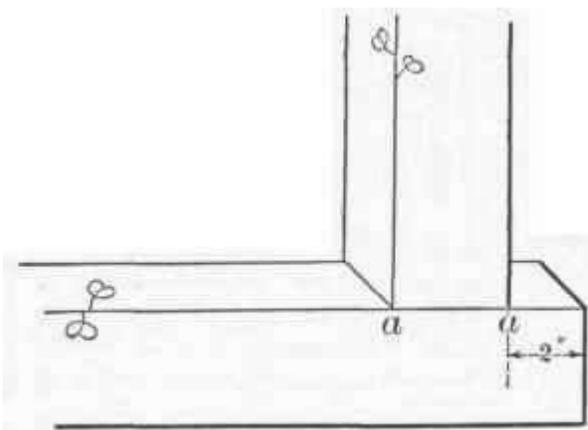


Fig. 1

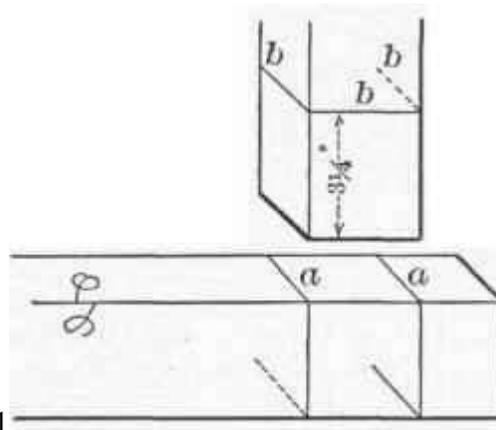


Fig. 2

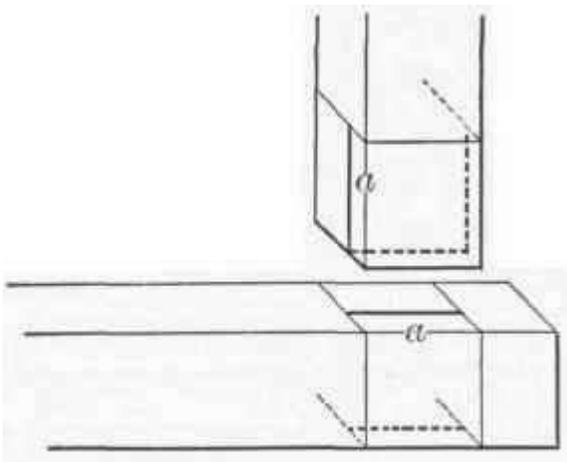


Fig. 3

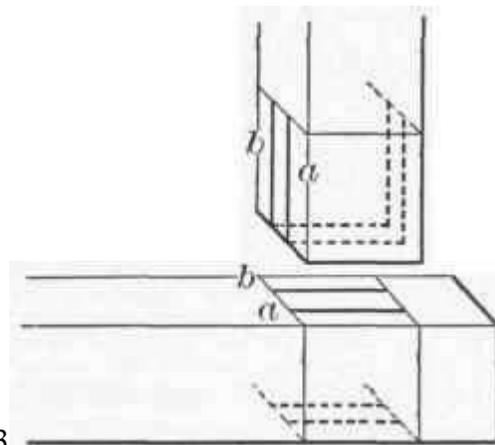


Fig. 4

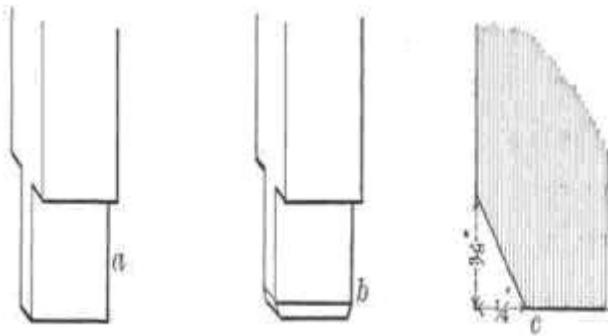


Fig. 5

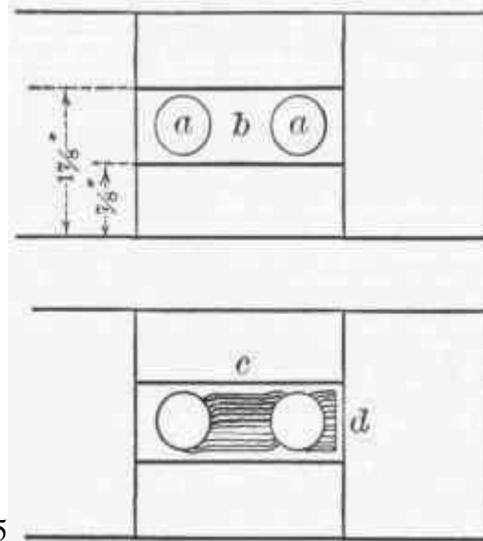


Fig. 6

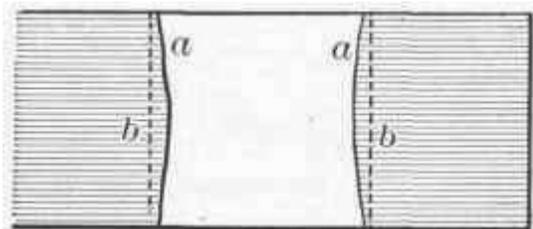


Fig. 7

4.0 Conclusion

The Practical was designed to provide flexibility and choice for both the learner and the teacher.

The Workshop Practice Course Material will provide broad guidance on approaches to learning and teaching which may apply to all Practical's of the Course.

Learning and teaching activities should have been designed to stimulate students' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated Assessment Standards. Learning should be supported by appropriate practical activities, so that skills are developed simultaneously with knowledge and understanding.

When delivering the Practical as part of the Workshop Practice Course, reference was made to the appropriate content statements within the syllabus.

'Further mandatory information on Course coverage' section of the Added Value Practical Specification to ensure the required breadth of knowledge is covered.

5.0 Reference

REFERENCE

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WELDING

1.0 Introduction

Shielded metal arc-welding (SMAW) is one of the oldest, simplest and most versatile joining process. Nearly half of all industrial and maintenance welding currently is performed by this process. The

electric arc is generated by touching the tip of a coated electrode against workpiece and withdrawing it quickly to a distance sufficient to maintain the arc.

The heat generated melts a portion of the electrode tip, its coating and the base metal in the immediate arc area. The Stick welding power source provides constant current (CC) and may be either alternating current (AC) or direct current (DC), depending on the electrode being used. The best welding characteristics are usually obtained using DC power sources.

The electrode coating deoxidizes the weld area provides a shielding gas to protect it from oxygen in the environment. This welding process can be accomplished by a number of different methods.

One primary difference in this method is the energy sources used for welding-an electric arc, gas flame, laser, even ultrasound. As a rule, welding is pretty much the same across industries, so welders have the flexibility of shifting from one industry to another, depending on demand. Today, welders are needed almost everywhere, welding careers are in demand right now. If you are good welding with some experience, you have got a real good chance of finding a job just about anywhere in country

2.0 Objectives

1. To perform on of the welding techniques and understand important of arc welding.
2. Define the problem that occurs on the arc welding.
3. Recognize the type of metal, electrode, and tools that are used in arc welding.
4. Recognize types of arc welding and steps to create the arc welding.
5. To know safety measure when use the welding machine along the welding process.

WORK PRACTICE NO. 1.0:

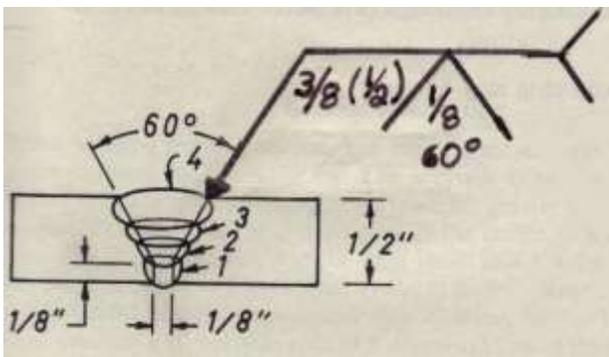
Objective: SMAW Vee butt joint in the flat position using 5/32" E6011, E6013, and E7018 electrodes on 1/2" thick x 2" wide x 3" long mild steel.

Setup: Using a properly set up and adjusted arc welding machine, proper safety equipment, 5/32", E6011, E6013, and E7018 electrodes, and mild steel plate, 1/2" thick by 2" wide x 3" long you will practice your skill to weld vee butt joints in the flat position. The test for this exercise will be 3 separate butt welds using each of the electrodes. This will require 6 pieces of 1/2" X 2" X 3" and a lot of edge preparation.

Procedure:

*The vee butt joint in this exercise is made by preparing two pieces of metal each with a 30-degree bevel as required by the plans. The space between the plates is called the root gap. Changes in the root gap can affect penetration. As the space increases, the weld penetration also increases. The root opening for most butt welds will vary from 0 in. to 1/8 in. To large an opening can cause burn through or a cold lap at the weld root. **This exercise will be done with a 1/8" root gap.***

1. Clean the base metal after grinding and position flat on the table. Tack weld joint at each end with a 1/8" root opening.
2. Lay root pass bead at the bottom of vee. Chip off slag and brush weld to remove any slag.
3. Run second, third, and fourth beads, or enough to fill the vee. Remember the slag must be cleaned out after each pass. Use a slight weaving motion for filler passes.
4. Wash the deposit up on each plate, so that a slightly concave bead is formed. It is easier to chip the slag out and assures good penetration into each plate.
5. When the vee becomes wider than 3 times the electrode diameter, lay two beads, rather than weaving a wide one.

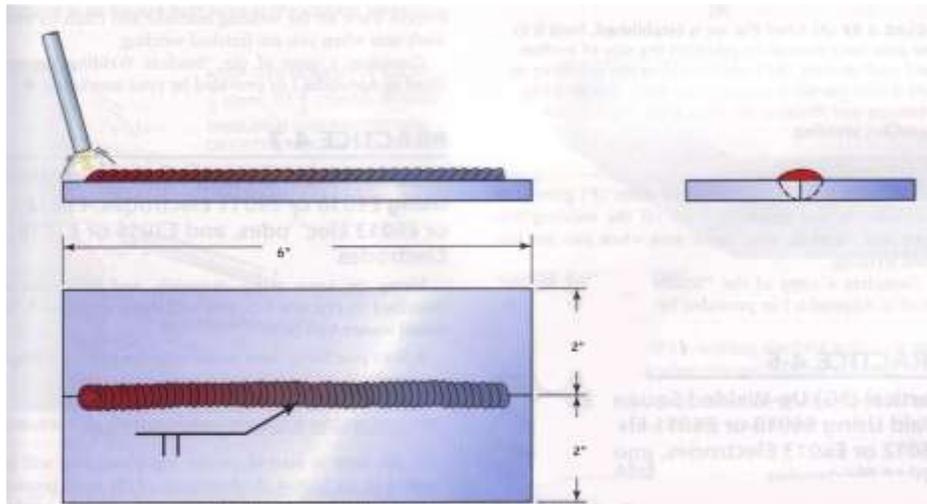


Observation: After cooling and chipping the slag off, inspect the beads for width, build up, molten weld pool size, spatter, and penetration. Record your observations on a Student Welding Report.

WORK PRACTICE NO. 2.0:

Objective: SMAW Closed Square butt joint in the flat position using 1/8" E6011, E6013, and E7018 electrodes on 1/4" thick x 2" wide x 6" long mild steel.

Setup: Using a properly set up and adjusted arc welding machine, proper safety equipment, 1/8", E6011, E6013, and E7018 electrodes, and mild steel plate, 1/4" thick by 2" wide x 6" long you will practice your skill to weld square butt joints in the flat position. The test for this exercise will be 3 separate butt welds using each of the electrodes. This will require 6 pieces of 1/4" X 2" X 6".



Procedure:

*The closed square butt joint is made by tack welding two flat pieces of plate together. The space between the plates is called the root gap. Changes in the root gap can affect penetration. As the space increases, the weld penetration also increases. The root opening for most butt welds will vary from 0 in. to 1/8 in. To large an opening can cause burn through or a cold lap at the weld root. **This exercise will be done with no root gap***

1. Tack weld the plates together and place them flat on the welding table. Starting at one end, establish a molten weld pool until it flows together.
2. After the gap is bridged, start weaving the electrode slowly back and forth across the joint.
3. Moving the electrode to quickly from side to side may result in slag being trapped in the joint.

Observation: After cooling and chipping the slag off, inspect the beads for width, buildup, molten weld pool size, spatter, and penetration. Record your observations on a Student Welding Report.

4.0 Conclusion

The Practical was designed to provide flexibility and choice for both the learner and the teacher.

The Workshop Practice Course Material will provide broad guidance on approaches to learning and teaching which may apply to all Practical's of the Course.

Learning and teaching activities should have been designed to stimulate students' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated Assessment Standards. Learning should be supported by appropriate practical activities, so that skills are developed simultaneously with knowledge and understanding.

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ON MACHINE TOOL PROCESS

1.0 Introduction

This practical is aimed at providing an introduction to the Know-how of common processes used in industries for manufacturing parts by removal of material in a controlled manner. Auxiliary methods for machining to desired accuracy and quality will also be covered. The emphasis throughout the laboratory course will be on understanding the basic features of the processes rather than details of constructions of machine, or common practices in manufacturing or acquiring skill in the operation of machines. Evidently, acquaintance with the machine is desirable and the laboratory sessions will provide adequate opportunity for this.

2.0 Objectives

The main objective of acquiring Workshop Practice knowledge is to help in solving practical agricultural problems. Specific objectives of Agricultural Workshop Practice are:

4. Is an essential aspect of our educational set up
5. it educates youths on the impact and opportunity in the Workshop Practice and agro-business.
6. It also exposes them to vast store of knowledge available for anyone contemplating owing or managing a farm.

Introductory Agricultural Workshop Practice refers to how the whole process of instruction is expected to occur.

By the end of this workshop practice practical the students should be able to:

- a. How to set up a typical workshop with different layout
- b. To know all the safety regulations in the workshop
- c. Know all various carpentry tools, materials, types of wood and their characteristics and Processes OR operations in wood working;
- d. How to Prepare simple joints: Cross half Lap joint and T-Halving joint, Dovetail joint, Mortise and tenor joint;
- e. Jobs on Bending, shaping, Drawing, Punching, Riveting;
- f. Introduction to tools and measuring instruments for ' / fitting;
- g. Jobs on sawing, filing and right-angle fitting of MS Flat;
- h. Practical in more complex fitting job;
- i. Operations of drilling" reaming, and threading with tap and dies; Practical test;
- j. Introduction to tools and operations in sheet metal work;
- k. Making different types of sheet metal joints using G.I. sheets.
- l. Jobs on welding, different types of joints

WORK PRACTICE NO.1: Introduction to Lathe Machine and Exercise on Turning

OBJECTIVE: To study the characteristic features of lathe.

3.0 Procedure for Conduct of Practical

MATERIAL

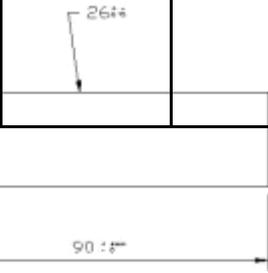
- 1. Lathe machine**
- 2. Working tools**

PROCEDURE

1. Run the machine at low speed and observe the motions, which control the shapes of the surfaces produced. Note particularly the features, which control the geometrical form of the surface.
2. Learn the names of the major units and the components of each machine. Record these details (Table A). (Please ensure that the main isolator switch is off and check that the machine. cannot be inadvertently started. Do not remove guards). Use the manufacture's handbook for details that cannot be inspected.
3. Record the obtainable speed and feed values (Table B).
4. Note down the special features of the speed and feed control on each machine.
5. Pay attention to the following:
 - Size specification of various machine tools.
 - Machine tool structures and guide ways / slide ways.
 - Drive mechanism for primary (cutting) motion.
 - Drive mechanism for secondary (feed) motion.

OBSERVATIONS: (a) Record the following in a tabular form:

Machine Tool Specifications (Table A)

| Machine | Type & Make | Size | Speed given to | | Feed given to | | Type of Surface Produced |
|---------|---|---|----------------|---------|---------------|------|--------------------------|
| | | | Tool | Work | Tool | Work | |
| lathe |  |  | | | | | |
| | | | 21 | 90 : 4" | | | 22 |

Speed and Feed Data (Table B)

| No. | Lathe | |
|-----|-------|------|
| | Speed | Feed |
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |
| 6. | | |
| 7. | | |
| 8. | | |

(b) Plot the lathe speeds against No. from Table B on a semi-log graph paper and show that the speed steps are in G.P.

PART (B): TURNING EXERCISE

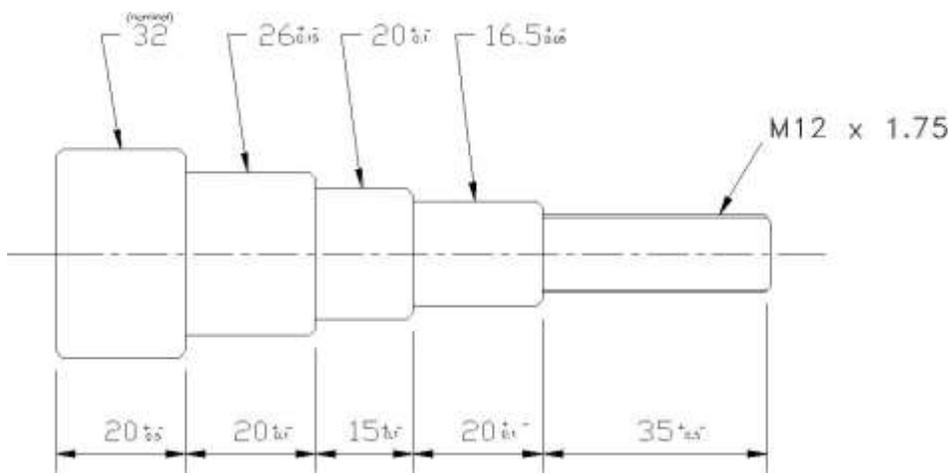
OBJECTIVE: To make the part shown in the sketch from a mild steel rod on a Lathe.

Machinery and equipment used

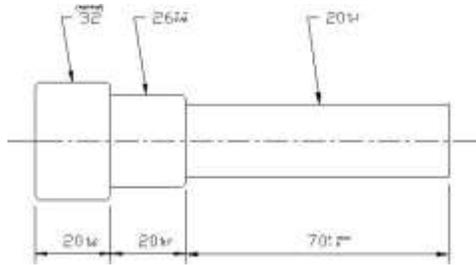
Cold cutting saw, centre lathe, pedestal grinder, HSS tool bit and straight or right-hand tool holder, centre drill, live centre, stock and die.

Procedure for making Turning Exercise

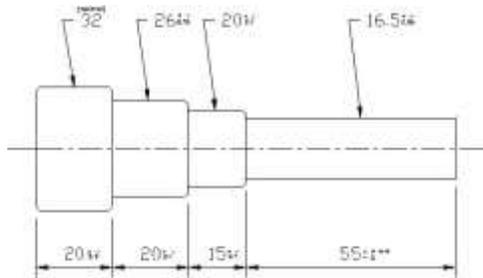
1. Cut material to length, with allowance for facing (115 approx.)
2. Face one end in the centre lathe.
3. Centre drill one end for the live centre.
4. Hold in the 3 jaw chuck by around 5-8 mm with the other end held by the live centre.
5. Turn the 26 mm diameter x 90 mm long (minimum length), leave at least 21 mm unturned of the starting diameter (approx 32 mm). Measure the outside diameter with the micrometer, size to finish at 26 mm + or - 0.15 (see diagram below)



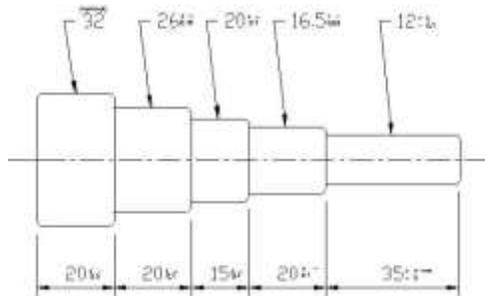
6. Turn the 20 mm diameter x at least 70 mm long - ensure that the diameter is left at 20 mm + or - 0.1 x 15 long. (See the diagram below).



7. Turn the 16.5 mm diameter x at least 55 mm long - ensure that the diameter is left at 16.5 mm + or - 0.05 x 20 mm long. (see the diagram below).



8. Turn the 12 mm diameter x at least 35 mm long - ensure that the diameter is left at 12 mm + 0.0 and - 0.1 x 35 mm long. (see the diagram below).



9. Face off the remaining material, so that the 12 diameter is left at 35 long (+ or - 0.5 mm).

10. Use the lathe (hand turn) and stock and die to start the M12 x 1.75 thread square. Thread up the shoulder of the 16.5 mm diameter.

OBSERVATIONS

- (a) Measure all dimensions (up to second decimal place) on the specimen turned by your group. Make a neat sketch and indicate all measured dimensions.
- (b) Discuss briefly how tapered portion was turned.
- (c) Show the calculation of the required gear ratio for thread cutting.
- (d) Sketch the main drive unit of the lathe and show how the speed steps are obtained.

WORK PRACTICE NO.2: MILLING: INTRODUCTION AND PRACTICE

PART (A)

OBJECTIVE: To study the characteristic features of Milling machine.

PROCEDURE

- i) Run the machine at low speed and observe the motions, which control the shapes of the surfaces produced. Note particularly the features, which control the geometrical form of the surface.
- ji) Learn the names of the major units and the components of each machine. Record these details (Table A). (Please ensure that the main isolator switch is off and check that the machine cannot be inadvertently started. Do not remove guards). Use the manufacture's handbook for details that cannot be inspected.
- jii) Record the obtainable speed and feed values (Table B).
- iv) Note down the special features of the speed and feed control on each machine.
- v) Pay attention to the following:
 - a. Size specification of various machine tools.
 - b. Machine tool structures and guide ways / slide ways.
 - c. Drive mechanism for primary (cutting) motion.
 - d. Drive mechanism for secondary (feed) motion.

OBSERVATION : Record the following in a tabular form:

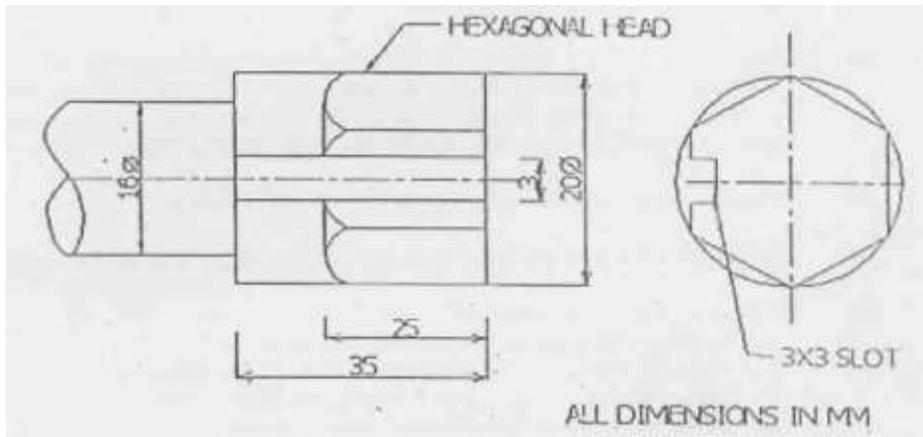
Machine Tool Specifications (Table A)

| Machine Type & Make | Size | Speed given to | Tool | Work Tool Work | Feed given to Surface | Type of Produced |
|---------------------|------|----------------|------|----------------|-----------------------|------------------|
| Milling m/c | | | | | | |

Speed and Feed Data (Table B)

| No. | Milling m/c. | |
|-----|--------------|------|
| | Speed | Feed |
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

PART (B) OBJECTIVE: To machine the hexagonal head and the slot shown in the sketch on the specimen,



EQUIPMENT: List all tools / cutters and instruments used.

PROCEDURE

Fit the helical cutter on the arbor and the specimen between the centers of the dividing head and the tail center. Carefully adjust the work piece so that the cutter just touches the top surface of the specimen. Calculate the necessary depth of cut and then mill the six *faces* of the hexagonal head in succession. Change the cutter and mill the rectangular slot.

OBSERVATIONS

- (a) Measure all dimensions (up to second decimal place) on the specimen milled by your group. Make a

neat sketch and indicate all measured dimensions.

- (b) Explain in brief how the required indexing was obtained with the dividing head.
- (c) Explain up-milling and down-milling operations. Which one did you use *for* slot milling and why?
- (d) Explain the advantages of using a helical milling cutter.

Exercise Questions. (All answers must be brief and to the point. Sketches must be neat and self-explanatory).

1. How is a milling cutter mounted?
2. What is the main difference between a horizontal and a vertical milling machine?
3. Explain what is meant by a universal milling machine.
4. Why are helical tooth milling cutters usually preferred over straight tooth cutters for slab milling?
5. Why is down milling generally avoided?
6. What are the advantages of up milling?
7. What special - attachment is needed in the milling machine to perform down milling?
8. In what respect does a slitting saw differ from a narrow milling cutter?
9. How are milling cutters generally classified?
10. What is the difference between a plain milling cutter and a side-milling cutter?

Work Practice NO 3: SHAPING: INTRODUCTION AND PRACTICE

PART (A)

OBJECTIVE: To study the characteristic features of Shaper.

PROCEDURE

- i) Run the machine at low speed and observe the motions, which control the shapes of the surfaces produced.

Note particularly the features, which control the geometrical form of the surface.

- ii) Learn the names of the major units and the components of each machine. Record these details (Table A).

(Please ensure that the main isolator switch is off and check that the machine cannot be inadvertently

started. Do not remove guards). Use the manufacture's handbook for details that cannot be inspected.

- iii) Record the obtainable speed and feed values (Table B).
- iv) Note down the special features of the speed and feed control on each machine.
- v) Pay attention to the following:
 - a. Size specification of various machine tools.
 - b. Machine tool structures and guide ways I slide ways.
 - c. Drive mechanism for primary (cutting) motion.
 - d. Drive mechanism for secondary (*feed*) motion.

OBSERVATION Record the following in a tabular form:

Machine Tool Specifications (Table A)

| Machine | Type & Make | Size | Speed given to | | Feed given to | | Type of Surface Produced |
|-------------|-------------|------|----------------|------|---------------|------|--------------------------|
| | | | Tool | Work | Tool | Work | |
| Shaper M/c. | | | | | | | |

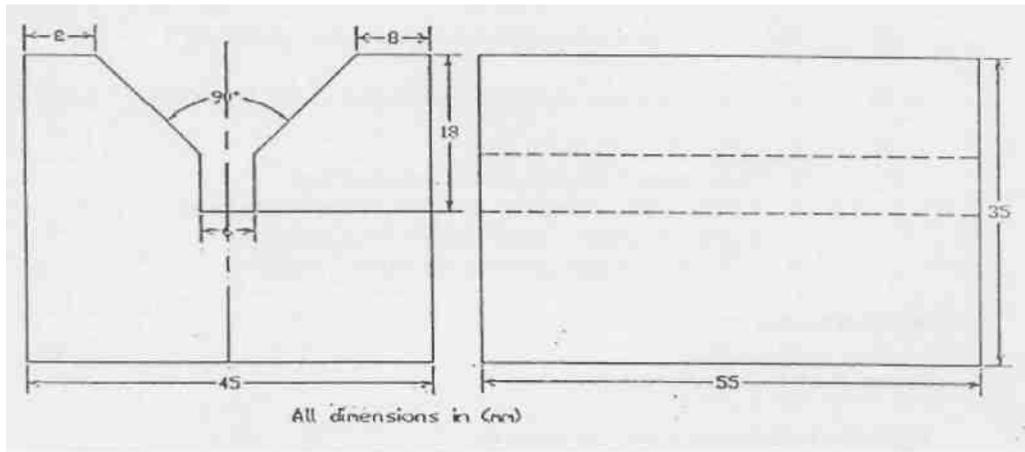
Speed and Feed Data (Table 2)

| No. | Shaper M/c. | |
|-----|-------------|------|
| | Speed | Feed |
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |
| | | |

PART (B)

OBJECTIVE:

To machine a V-block as shown in the sketch out of the workpiece provided.



EQUIPMENT

List all tools and instruments used.

PROCEDURE

1. Hold the work piece in a vice and machine the bottom surface shown in the sketch.
2. Invert the casting in the vice and machine the top surface till the desired height is obtained.
3. Machine the inclined faces using right and left hand tools.
4. Finally machine the groove.

OBSERVATIONS

- (a) Measure all dimensions (up to second decimal place) on the specimen machined by your group. Make a neat sketch and indicate all measured dimensions.
- (b) Explain the quick return mechanism.
- (c) Explain the use of clapper box on the machine.

EXERCISE QUESTION

1. What is the driving mechanism on the shaping machine?
2. Why is quick return effect important?
3. What happens to the quick return ratio when the stroke length is reduced?
4. How is feeding done on a shaping machine?

5. Why is clapper box provided on a shaper?

Work Practical NO 4: DRILLING AND FITTING

PART (A)

OBJECTIVE: To study the characteristic features of Drilling machine.

PROCEDURE

- i) Run the machine at low speed and observe the motions, which control the shapes of the surfaces produced.

Note particularly the features, which control the geometrical form of the surface.

- ji) Learn the names of the major units and the components of each machine. Record these details (Table A).

(Please ensure that the main isolator switch is off and check that the machine cannot be inadvertently started. Do not remove guards). Use the manufacture's handbook for details that cannot be inspected.

- jii) Record the obtainable speed and feed values (Table B).

- iv) Note down the special features *of* the speed and feed control on each machine,

- v) Pay attention to the following:

- a, Size specification *of* various machine tools,
- b, Machine tool structures and guide ways I slide ways.
- c. Drive mechanism for primary (cutting) motion,
- d. Drive mechanism for secondary (feed) motion.

- Vi) Drill geometry - check for angles

OBSERVATION

Record the following in a tabular form:

Machine Tool Specifications (Table A)

| Machine | Type & Make | Size | Speed given to | | Feed given to | | Type of Surface Produced |
|--------------|-------------|------|----------------|------|---------------|------|--------------------------|
| | | | Tool | Work | Tool | Work | |
| Drilling m/c | | | | | | | |

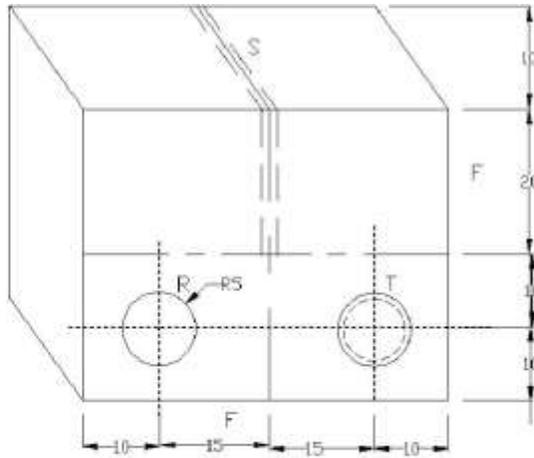
Speed and Feed Data (Table B)

| No. | Drilling M/c. | |
|-----|---------------|------|
| | Speed | Feed |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

PART (B)

OBJECTIVE:

To drill, file, as shown in the sketch, ream and tap holes on the mild steel plate.



R - Reamed hole 10mm

T - Tapped hole M 10

S - Saw cut

F - Filled edge

EQUIPMENT : List all tools and instruments used.

OUTLINE OF PROCEDURE

File only two surfaces which make 90° each other mild steel work piece ensuring with a tri-square that the angle is 90° . Mark two centers of the holes. Punch at the center and also punch full length of the hexa cut from top to bottom. Drill And ream the holes as required. Tap the hole a set of three taps

OBSERVATIONS

- Measure all dimensions (up to second decimal place) on the specimen made by your group. Make a neat sketch and indicate all measured dimensions.
- Explain how power is transmitted *from* drill spindle to drill shank.'
- Sketch a reamer and show its main features.

- (d) Explain why a set of three taps was used.

EXERCISE QUESTION

1. To which elements (tool and work) the speeds and feeds are provided on
2. Lathe (ii) Milling machine (m) Shaper and (iv) Drilling machine.
3. What type of speed variation mechanism is provided in the drilling machines you have studied?
4. What material is generally selected for the machine tool structure?
5. What types of guides are used for the main sideways of the basic machine tools?
6. How are the sizes of various basic machine tools specified?
7. Why are square threads used on driving screws of machine tools?
9. Which of the following processes are intermittent? (a) Milling (b) Drilling (c) Shaping (d) Turning
10. What makes the simultaneous rotation of the spindle and the feed motion possible on drilling machines?

4.0 Conclusion

This practical was aimed at providing an introduction to the Know-how of common processes used in industries for manufacturing parts by removal of material in a controlled manner. Auxiliary methods for machining to desired accuracy and quality will also be covered. The emphasis throughout the laboratory course will be on understanding the basic features of the processes rather than details of constructions of machine, or common practices in manufacturing or acquiring skill in the operation of machines. Evidently, acquaintance with the machine is desirable and the laboratory sessions will provide adequate opportunity for this.

6.0 Reference

1. Kwesi A. Workshop Theory and Practice. Nigeria. Faps Print. 2005
2. Atkins, E. A. Workshop Practice. Isaac Pitman.
3. Rajput R. K. Workshop Practice Laxmi Publications. 2009

4. Adeogun R., Toriola J. 2006. Workshop Theory and Practice. Twenty Publishers. Nigeria

5. Taiwo A., Jekayinfa S. O., Onawumi A.S. Mechanical Maintenance and Repairs. Orsome Publishers. Nigeria.

GENERAL SUMMARY

Workshop is a place where students acquire knowledge on the operation of various processes involved in manufacturing and production. The Workshop Practice course makes students competent in handling practical work in engineering environment. 'Workshop practice' is a method, a set of rules, a ritual, a set of guidelines or whatever another similar superlative/s you wish to apply.

The purpose is to ensure a repeatable and professional approach to the work, and hopefully its result. WHILE the theory of workshop practices is to familiarise the pupil with the numerous sorts of approaches and how they utilised interior the generating of things.

In all four practical assignments On Bench Work, On Bench work, On Welding and assignment On Machine Tool Process and ten work practices are discussed