

Manufacturing: Porthole Shelf

Introduction

The manufacturing industry uses three types of production systems to create a product. These systems are **custom production**, **job-lot production**, and **mass production**. **Custom production** is one in which workers manufacture products one at a time. These products have very unique **specifications** that fit the needs of that item alone. **Job-lot production** occurs when there is a need for only a limited number of the same product to be manufactured. **Mass production** is a process in which many of the same products are made through the **assembly line** process. This process must be planned very carefully to make full use of the materials and equipment needed to complete the product. **Jigs** and **fixtures** are often needed to manufacture a product. **Templates** (patterns) may also be used in the layout of the product.

The very first step in planning a mass production project is deciding what to produce. In industry, many hours are spent determining which products will be manufactured. Choosing the wrong product can cost the company large amounts of money. In order to make your final decision on a project, there are several questions that must be considered. These questions pertain to the skill level of the person making the project, time factors, cost factors, appeal of the product to both **genders**, and availability of tools and equipment needed to manufacture the product. If these questions are answered in a favorable light, then manufacturing of the product is **feasible**. After the project has been chosen, the next step is assembling all the necessary plans and set-ups.

Activity Description

In this activity you will construct a porthole shelf using the mass-production approach to manufacturing and assembly. A production line will be set up that requires each student or group to be responsible for the production of a **component** part of the porthole shelf. Remember, you are working with many people to achieve the common goal of production. This is a team effort. Everyone must do his/her part to ensure the success of the project.

Tools and Equipment

router
scrollsaw
bandsaw
table saw
drill press
sander

Materials and Supplies

1/8" x 4 1/4" x 4 1/4" acrylic mirrors
3/4" stock (pine, oak, walnut)
#8 x 1 1/2" flathead screws
sandpaper #80-200
stain (optional)
varnish
wood glue
3/4" wire brads
wood files
1/4" cove bit
1/16" door skins (mirror backing)

Procedures

A. Back (1)

1. The back has a finished length of 13 inches, but stock should be cut to a size of 6" x 13 1/4" to allow a margin for drawing the pattern.
2. Lay out the back pattern on a piece of 6" x 13 1/4" stock. Trace the pattern and mark all holes to be drilled in the shelf and brace area.
3. Cut out the pattern using a bandsaw. Do any shaping necessary with files.
4. Drill a hole in the porthole area so that the mirror hole may be cut out on the scrollsaw. The hole should be drilled as close as possible to the cutting line for the porthole.
5. Cut out the porthole using the scrollsaw. (Your instructor will explain how to make **internal** cuts.)
6. Lay out the 4 1/4 x 4 1/4 x 1/8" rabbet joint for the mirror **inlay**. Cut out the **inlay** for the mirror using the router. (This may be done freehand or using a guide for accuracy. Remember, this is going to be covered up with a mirror backing plate.)
7. Rout inside and outside edges of the back using a 1/4" cove bit. (Make sure all edges have been shaped properly before routing.)
8. Drill holes using the drill press and **countersink** them from the back.
9. Sand the back thoroughly with a #80 sandpaper, finishing with a #200 paper.
10. Transport to the assembly station.

B. Shelf (1)

1. On a table saw, cut out a piece of stock 4 1/2" X 4 1/2" .
2. Lay out the shelf cutting line on the stock using the shelf pattern.
3. Cut out the shelf using a bandsaw or scrollsaw. Do any shaping necessary with files.
4. Drill pilot holes 3/4" deep using the pattern to mark the hole location.
5. Rout the rounded edges of the shelf. Do not route the back edges of the shelf.
6. Sand the shelf thoroughly with a #80 sandpaper, finishing with #200 paper.
7. Transport to the assembly station.

C. Brace (1)

1. Cut out a piece of stock 2" X 3 1/4".
2. Lay out the brace pattern on the stock.
3. Cut out the brace using a bandsaw or scrollsaw. Use files to do any shaping necessary.
4. Drill a pilot hole 3/4" deep using the pattern to mark the hole location.
5. Sand the brace thoroughly with a #80 sandpaper, finishing with a #200 paper.
6. Transport to assembly station.

D. Mirror Backing (1)

1. Cut door skin to a finished size of 5" X 5".
2. Using a #100 paper, sand edges of backing to remove **burred** areas.
3. Transport to the assembly station.

E. Mirror (1)

1. Cut the acrylic mirror sheet to a finished size of $4\frac{1}{4}'' \times 4\frac{1}{4}''$.
2. Transport to the assembly station.

F. Assembly

1. Assemble the wood parts using wood glue

and screws.

2. Use a finish of your choice. (Pine may be stained and varnished; cherry or mahogany requires only varnish).
3. Install mirror and backing with wood glue and wire brads.
4. Complete a final inspection to ensure uniformity, overall quality, and **aesthetics**.

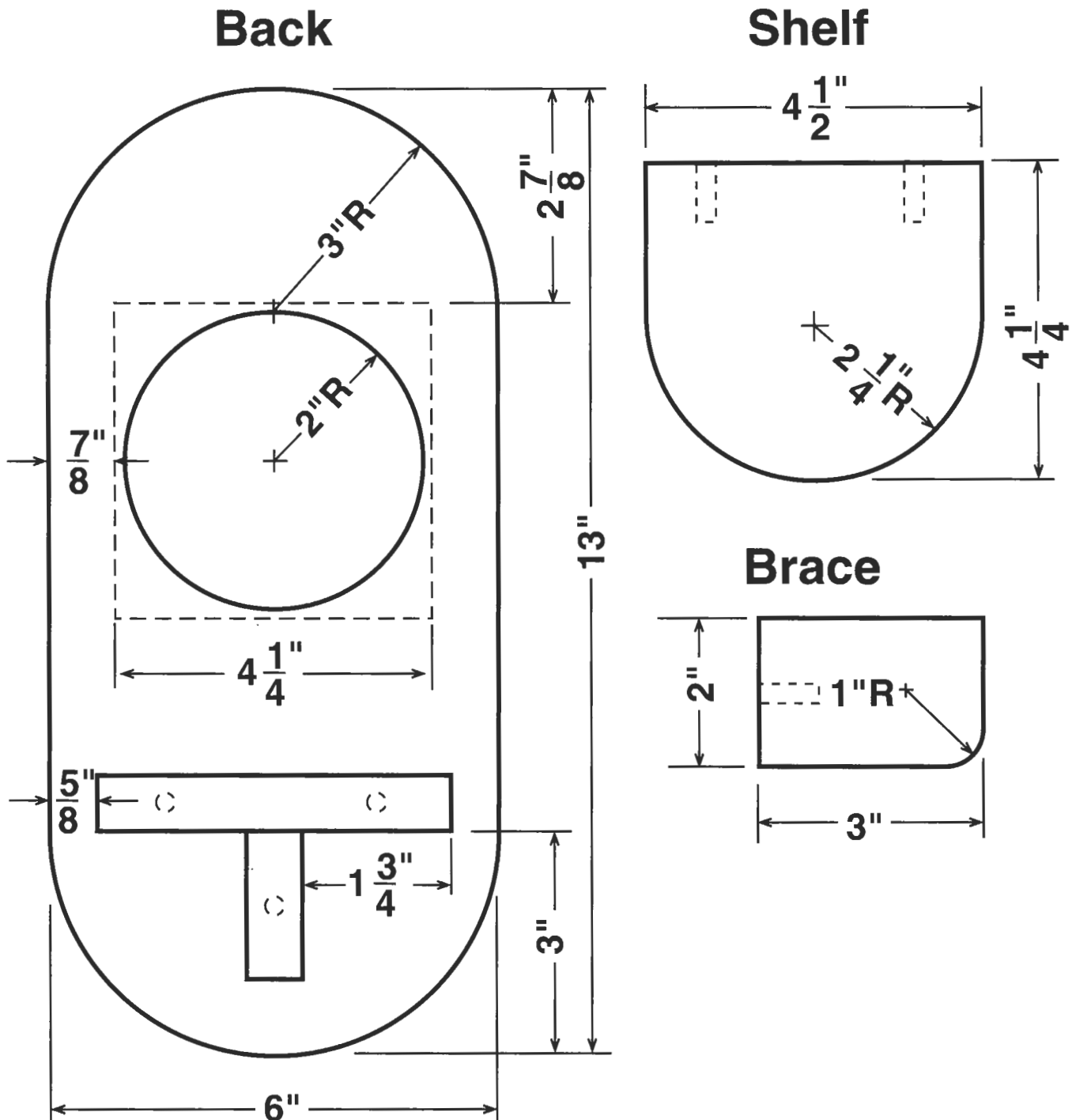


Figure 1 - Scale drawings for the major components of the porthole shelf.

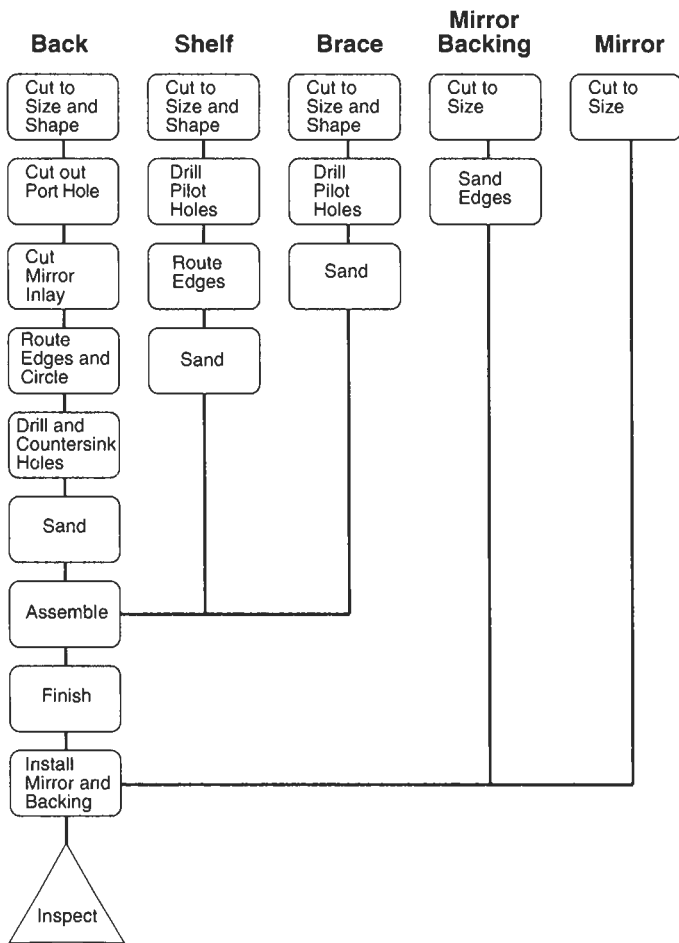


Figure 2 - Flowchart for the porthole shelf.

Safety

1. Your instructor will provide you with safety procedures for using power equipment and hand tools.
2. Always wear safety eye protection when working with any portable or stationary machinery.

Ecology


Dispose of all solvents and finish residue in a proper manner. Check with your instructor for the proper disposal method used at your facility. When using solvents and finishes make sure that you are working in a well-ventilated area. Be sure that you do not breathe the fumes of these dangerous chemicals.

Vocabulary

- burred
- countersink
- aesthetics
- internal
- inlay
- component
- fixtures
- jigs
- templates
- genders
- feasible
- specifications
- job-lot production
- mass production
- custom production
- assembly line

On Your Own

1. Identify a product that can be mass produced and make a flow chart outlining the basic procedures for manufacturing that product.
2. Go to the library and look up the history of manufacturing, utilizing the mass production approach. Write a report on your findings.



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TEACHER GUIDE
MANUFACTURING: PORTHOLE SHELF

Objectives: Upon completion of this activity, students will be able to:

1. Identify three types of production systems.
2. Describe three types of production systems.
3. Work cooperatively with others.
4. Demonstrate safe practices while working with tools and equipment.
5. Produce a product using the mass production approach.

Helpful Hints:

1. Pre-cut all stock to width so that considerable time will be saved on the production line.
2. All jigs and fixtures should be set up before production begins.
3. All internal and external edges should be shaped properly prior to routing.

LANGUAGE ARTS APPLICATION
MANUFACTURING: PORTHOLE SHELF

Student Name

In all types of jobs and occupations, you will need the skills to communicate with others in the workplace. Communication may be done orally, but in some situations the written form is more appropriate.

For this activity you are the supervisor of a production line in an industrial manufacturing company. You are told by management that production in your area is down by 20 percent in comparison to other production lines. Prepare a one-page memo explaining what needs to be done to improve your team's productivity.

**MATH APPLICATION
MANUFACTURING: PORTHOLE SHELF**

_____ Student Name

In all types of jobs and occupations you will at some point, need to be able to apply mathematical skills during employment.

People who work on the production lines or in managerial jobs constantly apply math skills to solve a variety of problems.

The following are examples in which math is used to solve or clarify everyday occupational tasks and situations.

1. A carpenter must trim $\frac{7}{16}$ of an inch from a door that is $26 \frac{11}{16}$ inches wide. After the door is trimmed, how wide will it be?

Answer: _____

2. Jerry has $2 \frac{3}{4}$ pounds of nails. Mary has $1 \frac{1}{2}$ pounds of nails. What is the difference in the weight between Jerry's and Mary's nails?

Answer: _____

3. After inspection on an assembly line, the product was found to be $\frac{1}{8}$ of an inch too long. The product was measured at 14 inches. What should be the correct length of the product?

Answer: _____

4. Willie spends four out of five days working on the production line. Use a fraction to represent the number of days Willie spends on the production line.

Answer: _____

5. A worker was told to cut $\frac{2}{3}$ off a product that was 15 inches long. How many inches must the worker cut off?

Answer: _____

6. On Friday $\frac{1}{8}$ of 120 employees were absent from work. How many employees were absent?

Answer: _____

7. On payday Sally netted \$524.35. Her deductions were \$45.10, \$125.40, \$5.50, and \$81.30. What was her total gross salary?

Answer: _____

8. After inspection, 30 percent of the 500 products manufactured that day failed to pass. How many products failed inspection?

Answer: _____

9. An order was received for 1,240 candle holders. In a five-day period, how many holders would be needed daily to complete the order?

Answer: _____

10. A company sold 85 percent of all products made. During the year, a total of 10,500 products were manufactured. How many products were actually sold?

Answer: _____

QUIZ

MANUFACTURING: PORTHOLE SHELF

Student Name

Completion: Vocabulary

1. _____ production is a process used when a limited number of products are needed.
2. Something that can be reasonably made, could also be called _____.
3. Another word for a pattern is _____.
4. The brace is a _____ of the porthole shelf.
5. One's sex could also be called one's _____.
6. The circle is the _____ part of the porthole shelf.
7. In order for a screw to fit flush on the wood surface you need to _____ the drilled hole.
8. The _____ of a project is its appearance.
9. _____ and _____ are aids used to make the manufacturing of a product easier and more accurate.
10. _____ production is when workers create several products one at a time.
11. An _____ is a process of moving products from one worker to the next worker for assembly.
12. _____ is a specific set of directions or guidelines for manufacturing a product.
13. Edges that are _____ need to be sanded.
14. _____ production is a process in which many alike products need to be made.
15. The mirror is put into _____ of the back.