

## Cluster #8 – Portable Router

### Primary Use

Portable routers are widely used for shaping the surfaces and edges of wood, and for joinery. It consists of a motor that is adjustable up or down in a base. A router can operate at speeds of 10,000 to almost 30,000 R.P.M. A collet [chuck], attached to the end of the motor, holds the cutting tool. The kind of work that can be done with the router depends on the cutters, fixtures and attachments used.

### Important Parts

The important parts of the Portable Router are: [the parts may be common to most routers but not to all]

*Spindle Lock* - The spindle lock prevents the motor from turning while you tighten or loosen the collet when adding, removing or adjusting a router bit. [Some routers do not use a spindle lock]

*Depth Adjustment Ring* - The depth adjustment ring allows you to accurately adjust the depth of cut.

*Locking Clamp* - The locking clamp secures the motor housing in the base.

### Router Bits (cutters)

- Bits come with shanks of: 1/8," ?" and ?"
- Bits come with or without pilots [guides]. Some have ball bearings some do not.
- Some bits have carbide cutting edges some do not.
- The diameter of the router bit may determine the safe RPM speed of the router.

### Adjustments of the Tool

Installing and Removing cutters

- Unplug the router
- Place it on the table collet up.
- Loosen the collet by turning counterclockwise. A second wrench may be needed to keep the motor from turning.
- Insert shank of cutter into collet. The shank of the cutter should be close to, but not touching, the bottom of the collet. Back it out about 1/16 inch.
- Tighten the collet nut securely by turning clockwise with the wrench provided with the router.

**NOTE: Be sure that the cutter and the collet match in size.** Example: 1/4" collet to 1/4" shank and 1/2" collet to 1/2" shank.

**CAUTION – DO NOT USE ROUTER BITS WITH A DIAMETER IN EXCESS OF 1 1/2 INCHES IN THE HAND HELD PORTER-CABLE ROUTER MODEL #1001.**

### *Adjusting Depth of cut for edge routing*

- Unplug the router.
- Place the router on edge of the workpiece and loosen the locking arm.
- Set the depth of the cut against the edge of the board to position the cutter to your exact setting.

*Adjusting depth of cut for surface routing* (the use of a template would be required) It is recommended that cuts be made at a depth not exceeding 1/8" and that several passes be made to reach depth of cut greater than 1/8"

- Unplug the router
- Place router on a flat surface and loosen locking arm.
- Turn depth adjusting ring until tip of cutter touches flat surface.
- Turn the depth indicator ring until the zero lines up with the indicator point on the base.
- Position router so that the cutter can extend below the subbase for desired depth setting.
- Turn the depth adjusting ring to obtain the desired depth of cut.
- Tighten locking arm securely.

### **Using a Plunge Router**

A plunge router allows you to adjust the depth of cut while the router is turned on. This feature can come in handy when you need to make multiple passes on a board, taking off slightly more wood with each pass. Plunge routers often have depth stops that can be used to accurately plunge the router to the appropriate depth while in use. Plunge routers can also be used to cut stop grooves, dado and incised letters (with special jigs).

### **Using the Router and moving it in the correct direction**

- The router bit revolves clockwise. Therefore, when cutting straight outside edges, move the router from left to right. When making circular outside cuts, move the router in a counterclockwise direction.
- Whenever cutting on an inside edge, move the router in a clockwise direction. In other words always cut opposite the rotation of the router bit.
- When making cuts on all four edges of the workpiece, make the first cut on the end of the workpiece across the grain. Thus, if chipping of wood occurs at the end of the cut, it will be removed when making the next cut parallel with the grain.
- Depending on the workpiece, more than one cut may be necessary to avoid overloading the motor in exceptionally hard wood or to get to the desired depth of cut.
- When "Climb-Cutting" is required [backing up at a corner], exercise extreme caution to maintain control of router.
- Do not move the router too slowly across the edge of the workpiece. Moving too slowly may cause the tool to burn the wood.

## **Feeding the Router at the Correct Speed**

The proper rate of feed depends on several factors:

1. The hardness and moisture content of the wood
2. The depth of the cut.
3. The cutting diameter of the bit.

The best rate of feed is one that does not slow down the router motor more than one-third of its no-load speed. You can detect "force feeding" by the sound of the motor. Its highpitched whine will sound lower and stronger as speed is reduced. Too slow a feed can be detected by the high-pitched sound of the motor that doesn't change, or by feeling the "wiggle" of the bit in the cut. Keep in mind that too fast a feed can induce chipping and tear out and an excessively slow rate of feed can result in heat buildup and burning.

## **Safety**

- **Always wear eye protection.**
- Do not change a bit or change the depth of cut without unplugging the machine.
- Do not use router bits with a diameter in excess of 2? inches at RPM above 13,000.

Router bits up to 3? inches in diameter can be used when speed control is 13,000RPM or less.

- Do not start the router when the bit is in contact with the workpiece.
- Do not overreach. Keep proper footing and balance at all times.
- Turn on the router and let the motor build up to full speed before routing, and keep a firm grip on the router to resist the starting torque.
- Always be sure the work is rigidly clamped or otherwise secured before making a cut.
- Be sure nothing will obstruct the router bit or router base anywhere along the cut.
- Keep the base of the router flat on the surface of the workpiece.
- Do not hand hold the router in an upside-down or horizontal position. The motor can separate from the base if not properly attached.
- Upon completion of a cut, turn motor off and let it come to a complete stop before removing the router from the work. Never remove the router from the workpiece and place it upside down on the work surface before the cutter stops.
- Always grasp and hold your router firmly with both hands when routing.
- Roll sleeves above the elbow. Don't wear loose clothing, loose jewelry.

## **ROUTER, MEMBER DEMONSTRATION**

**Put your safety glasses on.**

Have each member perform the following with a ?" x 8" x 16" Pine Board.

- Install a 1/8" rounding over bit into the router and round all four edges of the board. Be sure to follow the correct order of cutting.
- Lower the cutting depth 1/8" by setting the depth control ring to "0" (zero) and turn and lower the motor to the 1/8" mark. Cut again with the addition of a square shoulder to the rounding over bit.
- Reset the motor to the previous position and cut inside opening; being sure to move the router clockwise.

If a member is unsure with what they did, that member may repeat the hands-on operation.

## **Cluster #8 - Router Table**

### **Primary Use**

The router table is primarily used for edge cutting on straight and curved pieces, for making decorative edges and moldings, for producing joints, and for grooving, fluting and beading.

### **Important parts**

The router table is simply a table that has a heavy-duty router mounted underneath allowing its bit to extend above the work surface of the table. There are adjustments on the table that can raise or lower the height of the router so as to change the cutting depth. An adjustable fence is used as a gauge to further adjust the depth of cut.

### **Adjusting for the cut**

- The opening between the two faces of the fence can be made wider or narrower. It should never be larger than is required for the cut.
- The entire fence can be adjusted forward and back.
- Expose only as much of the bit in front of the fence as you plan to cut on the first pass, if more than one pass is necessary (heavy or deep cuts).
- Set the router bit to the correct height.
- Whenever possible, use the feather boards to keep the work against the table and against the fence.
- Use a push stick to feed the work across the cutting bit.

### **End Grain Routing**

Shaping end grain with a router table and square push block has three advantages over end-grain routing with a handheld router. First, you're not limited to bearing-guided bits, since the fence is guiding the cut. Second, unlike with handheld routers, it's just as easy to rout narrow pieces as wide ones. And finally, the push block backs up the cut to eliminate the chipping and tear-out commonly associated with end-grain routing.

## Moving the Wood in the Correct Direction

The cutting bit revolves in a counterclockwise direction. Therefore, always feed along the fence from right to left. **Always feed against the cutting action, that is, feed the work into the cutters in the direction opposite to the cutting rotation.**

## Suggested Cutting Speeds for Various Diameter Bits

The larger the diameter of the cutter the faster the tips of it travel; a large bit will be traveling too fast for optimum performance and safety on a router at full speed unless the RPM is slowed.

### Suggested Maximum Router Bit Speeds

	Bit Diameter	Maximum Speed
	1"	24,000 RPM
	1.25" to 2"	18,000
RPM	2.25" to 2.5"	
16,000 RPM	3" to 3.5"	12,000 RPM

Remember, these are suggested maximum speeds! Your equipment and/or situation could require much lower speeds for performance and safety. Example: At 22,000 RPM the tip of a 1" bit travel at 49 MPH; on a 3" bit they would be traveling over 220 MPH.

The router table uses a Porter-Cable #7518, 3 $\frac{1}{2}$  peak HP, five-speed router. The RPM speeds are: 10,000, 13,000, 16,000, 19,000 and 21,000.

It is recommended the speed be set prior to engaging the router bit into the work. Should it be necessary to change the speed after work has begun, stop the router, remove the work clear of the router bit, and adjust speed setting. The router slide speed adjustment is located at the top of the router body under the table.

## Safety

- **Always Wear Eye Protection.**
- Never route a piece of wood shorter than 10" without the use of a support block or feather board.
- Whenever possible, install the cutting bit so the bottom of the stock is routed. In this way the stock will cover most of the cutter and act as a guard.
- Make sure the cutting bit is locked securely to the spindle.
- Always position the left fence so it will support the work that has passed the cutting bit.
- After adjusting the cutter for correct height, ensure it clears the fence.
- Examine the stock carefully before cutting to ensure it is free of defects.
- Never cut through a loose knot or stock that is cracked or split.

- Push the bit into the collet. Then lift it to expose about one-quarter of the shank before tightening the collet nut. This will keep the bit from coming loose in the collet. At least two-thirds of the bit's shank should be engaged in the router collet.
- Cover the bit with a guard whenever possible.
- Use featherboards and push stick to keep your fingers away from the bit.
- Move workpieces from right to left against the fence.
- Never position the fence so the workpiece gets pushed between it and the bit.
- Roll sleeves above the elbow. Don't wear loose clothing, loose jewelry.

## **Cluster #8 – Trim Router and Router Bits**