

# Fabrication Instructions

## Basic Ikebana Vase

December 16, 2011 © g-codesource.com

Photographs show what the final product looks like



Please read this document **all the way through** at least once before starting fabrication!

**To produce this product, you must have:**

This is the resources section describing everything needed to produce the part

1. Knowledge of:
  - wood/machine shop fundamentals and
  - how to set up a CNC mill or router, load and change tools
  - some knowledge of g-code programming.
2. A CNC mill or CNC Router that:
  - accepts the following g-code commands

Command	Description	Command	Description
G00	Linear motion, rapid	M0	Pause program execution
G01	Linear motion, at speed setting	M2	End program
G02	Circular motion, clockwise	M3	Start spindle rotation
G03	Circular motion, counterclockwise	M5	Stop spindle rotation
G20	Inch mode	M6	Tool change
F	Motion speed setting	S	Spindle RPM setting

- Has the following minimum range of travel: X, 7.875"; Y, 5.25", Z, 2.6875"
3. Cutters: The tool table for this project is shown below.

Tool Description	Tool Number	Minimum Cut Length (inches)
1/2 inch Flat	14	1
60° Engrave	32	Not Applicable

4. Programs: Ikebana Basic, First Op, Top and Ikebana Basic, Last Op, Bottom
5. Other Tools:
  - A Table Square
  - Clamps for securing materials to the mill or router bed
  - Standard woodshop tools for measuring and cutting stock
  - A power sander
6. Materials: Wood board at least 5" x 7-3/8" by 1-1/2" thick

**Caution:**

Cutting machinery is inherently dangerous. Follow the manufacturer's instructions for your power equipment. Never reach in towards cutters when the tool is running.

Suggest a test material. If the test can be done with dimension lumber, tell

**Recommendation:**

Different woods, different cutters, and different machines can give different results. It is recommended that you use a test material for the first run of the program to familiarize with the program. This item can be tested using a construction grade 2 X 6 cut to length.

**Major Fabrication Steps:**

There are five major steps to making this part. The major steps are:

1. Prepare the wood stock by cutting to size and marking
2. Prepare the CNC machine by installing the tool
3. Clamp the wood stock to the bed of the mill or router
4. Flip the wood stock over, clamp, and run the **Last** program

List every major step of the fabrication process here. Each step is described later in detail. Always start with preparing the stock followed by setting up the machine. Always end with finishing the part.

5. Remove the part from the bed, cut away the tabs, sand and finish. The following sections give details on each step.

Use a table to give stock dimension targets and ranges

**Step 1, Prepare the Stock**

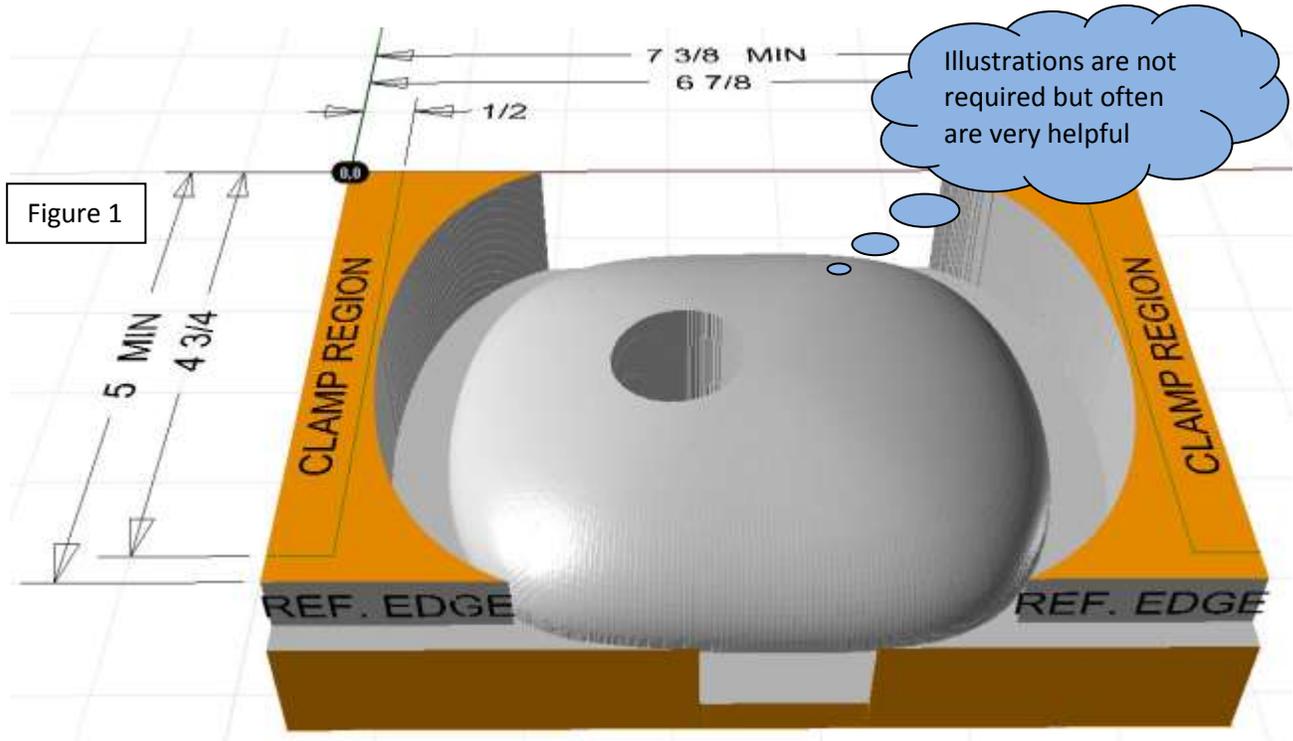
- **Action:** Cut the stock to size. The table below gives the dimension ranges

Direction	Axis	Target	Minimum	Maximum
Width (across grain)	X	5.125 (5-1/8)	5.000 (5)	5.500 (5-1/2)
Length (with grain)	Y	7.375 (7-3/8)	7.375 (7-3/8)	Lo
Thickness	Z	1.500 (1-1/2)	1.469 (1-15/32)	

Give guidance on clamping locations

For length, having longer stock does not affect the process.

- **Action:** Using a pencil, mark the clamp region on the top side. This is so you can locate clamps. The clamp region is shown in Figure 1. Figure 1 also shows the shape of the part after running the **First** program. The clamp region is free from cutting. Actual clamp position must take into account collet clearance.



Illustrations are not required but often are very helpful

Figure 1

**Step 2, Prepare the CNC Machine**

- **Information:** This program requires cutting the part in two cuts. The cuts on each side have to be aligned with the center for the part. Generally is not exact, the program cuts a reference edge. The reference edge is shown in the previous illustration.
- **Information:** To use the program, an "L" square should be installed on the CNC machine. The "L" square installed.

The steps are either Action or Information. Action is something the person needs to do. Information is something they should know about.

Figure 2

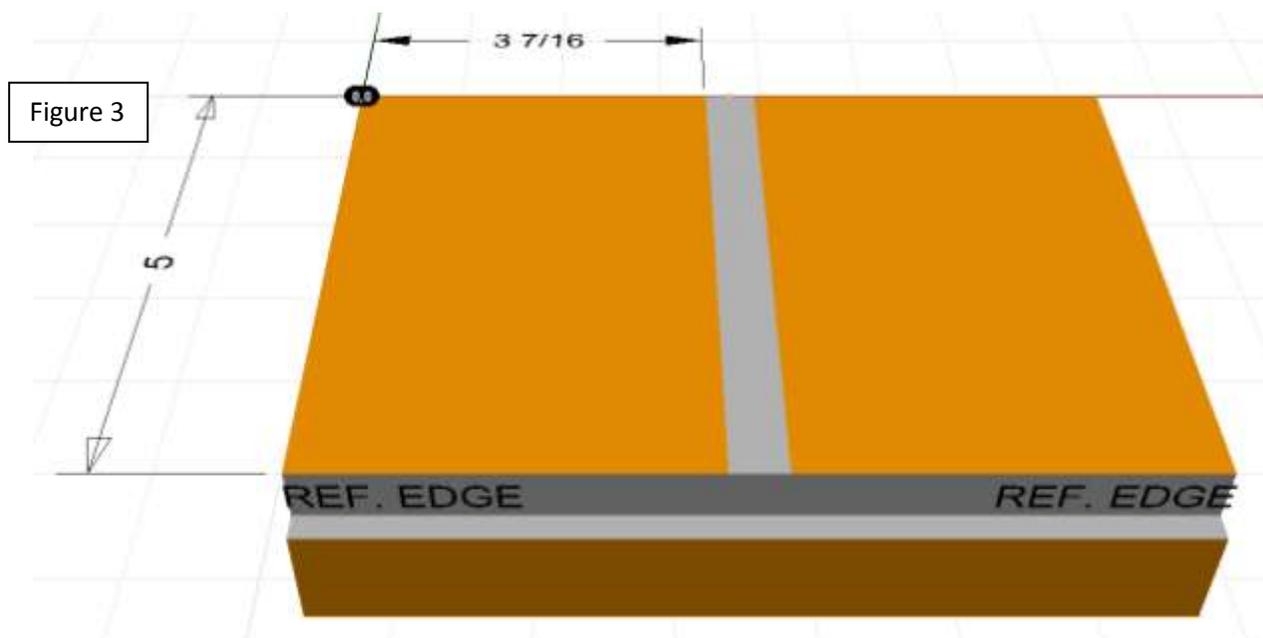


- **Information:** The configuration and installation of a Table Square is something that has to be done specific for your machine. The Table Square can be a modified carpenter's square as shown in the photograph, but it can be any low-profile square. Even a straight edge or straight piece of short stock can work if set at  $Y = 0$  for the reference edge. A clamp fastened to the table can work for the  $X = 0$  reference.
- **Action:** Install a Table Square or equivalent on the bed of your CNC machine and set  $Y = 0$  and  $X = 0$  at the inside edges of the table square.

### Step 3, Clamp Stock and run the First Program

- **Action:** Securely clamp the stock on the machine bed. The stock should be butted against the  $Y = 0$  face of the table square and the  $X = 0$  face of the Table square.
- **Action:** Load the *First* program into the CNC machine.
- **Action:** Install the cutting tool, and verify that the face of the cutting tool is flush with or skims the top surface of the stock.
- **Action:** Start running the machine and program. The first segment that will run will be a set-up check routine. This will do one pass cut skimming the top of the stock and will cut the reference edge. The CNC machine should pause (if the CNC machine recognizes the pause command), and allow verifying that the set-up is correct. After running the set-up check, the part should look as shown in Figure 3 where a skim cut just grazed the surface of the stock starting at  $X = 3-7/16$ " and the stock width measures 5" from  $Y = 0$  to the reference edge. If the set-up check did not verify as shown, correct the set-up before continuing.

Every **Action** should be a single activity. If several activities are needed in succession, break them up into separate action items.



- **Action:** Select *Continue* or *Run* on your CNC machine to end the pause and allow the program to run through completion. The part should look like Figure 1 when complete.
- **Information:** The steps of the program are shown in the following table.

Line Number	PROGRAM FLOW, Ikebana Basic, First Op, Top, Ver_.nc	Run time at original settings
3	Machine initialization	
6	Install Tool 14, ½ inch diam end cutter	
12	Set-up check and cut reference	1 min
25	Outline of part (four passes)	7 min
699	Clearance for cutter, rough	1 min
1020	Well perimeter (the well is)	1 min
1032	Well bottom, cleaning up th	0 min
1037	Cross body shape, cross grain par	26 min
9429	Body shape, right end, with grain parallel cutting for shape	12 min
13728	Body shape, left end, with grain parallel cutting for shape	12 min
17954	End	

Include a table for every individual program. The descriptions coincide with the program comments per the g-codesource.com standard.

- **Information:** If the program run is interrupted at any point and needs to be restarted, the best place to restart this program is at the beginning.

#### Step 4, Flip Stock and run the Last Program

- **Action:** Remove the part from the bed. Clean away any chips or rough edges that could get in the way of aligning the stock. Flip the part so the reference edge is against the Y = 0 face of the Table Square. The same end of the stock that was against X = 0 remains against the X = 0 face of the Table Square.
- **Action:** Secure the part to the machine bed. The clamp region is shown in Figure 4. The clamp region is free from cutting. Actual clamp position must take into account collet clearance.



- **Action:** Select *Continue* or *Run* on your CNC machine to end the pause and allow the program to run through completion. The part should look like Figure 3 when complete.
- **Action:** At the tool change install an engraving bit. Set the engraving bit tip Z = 0 at 1-1/2 inches above the machine bed.
- **Information:** The engraving on the bottom face is optional. If you don't want any or all of the engraving, remove the appropriate sections from the program or stop execution of the program. If you want to replace the engraving with your own engraving, Figure 4 shows the X and Y coordinates for the engraving area. The engraving face is located at Z = -0.0625".
- **Information:** The steps of the program are shown in the following table.

Line Number	PROGRAM FLOW, Ikebana Basic, Last Op, Bottom, Ver_.nc	Run time at original settings
3	Machine initialization	
6	Install Tool 14, ½ inch diameter flat end cutter (should already be installed)	
12	Lock	1 min
26	B7	1 min
145	C	7 min
1710		7 min
3285		27 min
6041		1 min
6182	Bit	
6188	Left	3 min
7546	Right Dragonfly Engraving	5 min
8904	Circle engraving	0 min
8910	Kanji Dream Logo engraving	1 min
9179	"Made in" text engraving	1 min
9912	"USA" text engraving	1 min
10385	End	

Per the standard, the line numbers are not embedded into the program but can be gotten from an editor. This helps the user find a section in the program.

While you may have the run times to the second, round off to the closest minute. The number is to give customers expectations for long versus short operations (take coffee break or stay by the machine).

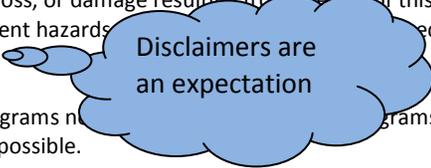
- **Information:** If the program runs to completion, the next step is to restart this program is at line 6 if the program is running, or at line 6182 if the interruption occurred while the program is running.

### Step 5, manually finishing the parts

- **Action:** Remove the machined parts from the mill or router. Cut away the tabs using a coping saw or similar saw, being careful not to cut into the part.
- **Action:** Sand away the remainder of the holding tabs.
- **Action:** Detail sand the part to the surface finish you desire.
- **Action:** Apply the finish of your choice to the part.
- Enjoy!

**Legal:**

The user of this software is responsible for all liability, loss, or damage resulting from the use of this program or any modified versions of this program. Cutting equipment has inherent hazards and requires proper instructions for the machinery this program is used on.



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an expectation

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