

# DESIGN AND FABRICATION OF A INDEXING DRILL JIG USING PRO/E WILDFIRE 4.0 AND MATLAB

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**Abstract** - The Employment of jigs and fixtures is an important aspect of Workshop Engineering for the Production of Articles in large quantities with a High Degree of Accuracy and Interchangeability at a Competitive Cost. The purpose of jigs and fixtures is to maintain Low Manufacturing Costs and to Increase Industrial Efficiency. Thus the jigs and fixtures are mainly used to Reduce Costs and Ensure Interchangeability which allows for rapid assembly. Its purpose is also to speed up machining times by eliminating time of handling and setting of the component parts.

Further jigs and fixtures are taking the place of the skilled man in the production factory and making it possible to employ unskilled or semi- skilled operators. The primary objective of the use of jigs and fixtures is to facilitate the holding and supporting of the component by using fixtures, to position it properly and guide the cutters so that every component will be uniform. It is also employed to accommodate several components at one setting and thus taking advantage of multiple machining. It is particularly very suitable where correct positioning of various holes at various exact places is important and which otherwise would consume lot of time in marking etc

**Keywords:** Jigs, Fixtures, Machining, Cost

## I. INTRODUCTION:

Tool design is concerned with design and development of machines and special tooling, methods and techniques required by today's high speed mass manufacture at high efficiency and productivity. Its main objective is to produce component at a competitive price, maintaining quality and increased production. All this calls for selection of best tool materials for adequate tool life, providing simple and easy to operate tools for high efficiency, design of tools to be fool proof with no possibility of wrong operation, quality consciousness at all levels.

The employment of JIGS and FIXTURES is an important aspect of workshop engineering for the production of articles in large quantities with a high degree of accuracy and interchangeability at a competitive cost. The primary objective of the use of jigs and fixtures is to facilitate the holding and supporting of the component by using fixtures, position it properly and guide the cutters so that every component will be uniform. It is also employed to accommodate several components at one setting and thus taking advantage of multiple machining. It is particularly

very suitable where correct positioning of various holes at various exact places is important and which otherwise would consume lot of time in marking etc.

## II. DESIGN PARAMETERS:

PRO E is one of the world's leading CAD/CAM/CAE packages. Being a solid modeling tool, it not only unites the 3D parametric features with 2D tools, but also addresses design-through-manufacturing process. The Bi-directionally associative nature of this software ensures that the modifications made in the model are reflected in the drawing views and vice versa. PRO E serves the basic design tasks by providing different workbenches. A work bench is defined as a specified as a specified environment consisting of a set of tools, which allows the user to perform specific design tasks in particular area. The basic workbenches in PRO E are as follows:

- Part Workbench
- Wire frame and Surface Design workbench
- Assembly Design Workbench
- Drafting Workbench

The Drafting workbench is used for the documentation of the parts or assemblies created earlier in the form of drawing views and their detailing. There are two types of drafting techniques.

1. Generative Drafting
2. Interactive Drafting

The generative drafting technique is used to automatically generate the drawing views of the parts and assemblies. The parametric dimensions added to the component in the part design workbench during its creation can also be generated and displayed automatically in the drawing views. The generative drafting is bi-directionally associative in nature. We can also generate the Bill of Material (BOM) and balloons in the drawing views.

In interactive drafting, we need to create the drawing views by sketching the using the normal sketching tools and then adding dimensions.

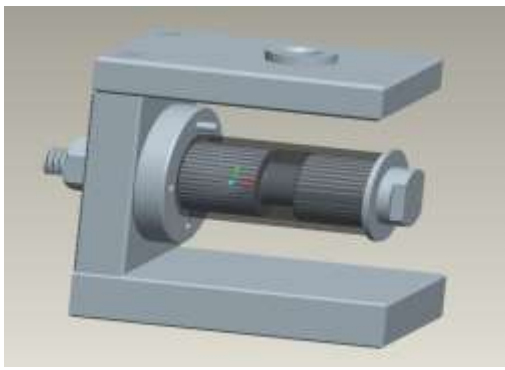


Figure 1. Indexing drill jig

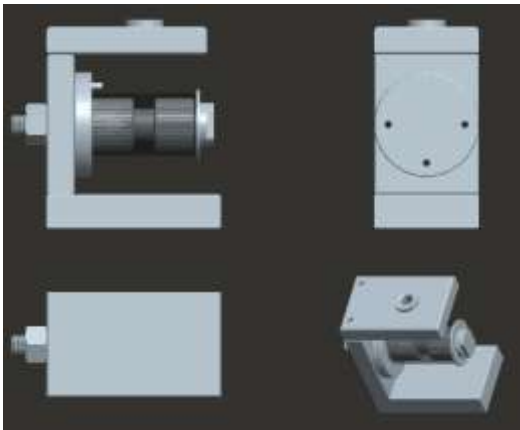


Figure 2. Different views of indexing drill jig.

Bill Of Materials

Sno.	Part Name	Size (mm.)	Material	Operation	Quantity	Other process	Weight(Kg.)
1	TOP PLATE	92 x 60 x 16	Mild steel	Milling,Drilling	1	-	0.69
2	MIDDLE PLATE	80 x 60 x 16	Mild steel	Milling,Drilling,Tapping	1	-	0.60
3	BOTTOM PLATE	100 x 60 x 20	Mild steel	Milling,Drilling	1	-	0.94
4	LOCATOR	100 x 105	Mild steel	Turning,Threading,Tapping	1	Hardened	2.30
5	DRILL BUSH	220 x 22	Brass	Turning,Drilling	1	Hardened	0.05
6	COMPONENT	236 x 63	Mild steel	Turning	1	-	0.48
7	FRONT LOCKING WASHER	240 x 2	Mild steel	Turning and Milling	1	-	0.02
8	INDEXING PIN	26 x 32	Mild steel	Turning	1	Hardened	0.01
9	FRONT LOCKING NUT	225 x 23	Mild steel	Turning	1	-	0.09
10	ALLEN KEY	M6 x 30	Standard	Standard	4	Standard	-
11	BACK NUT	M8	Standard	Standard	1	Standard	-
Total Weight							5.22

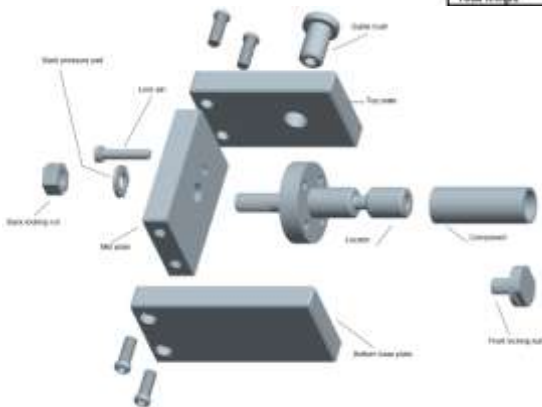


Figure 3. Exploded view with parts name

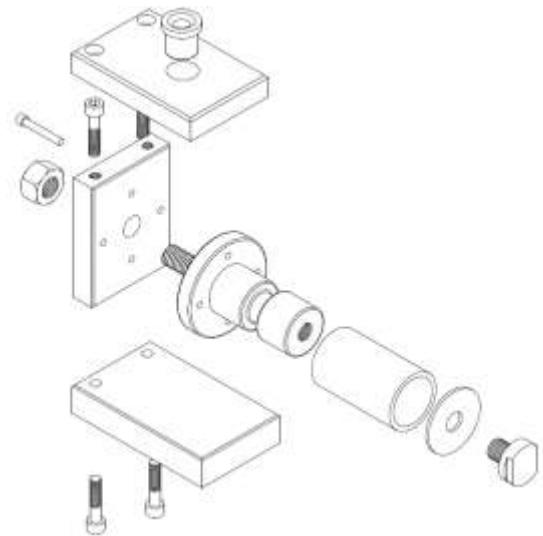


Figure 4. Exploded view (wire frame)

MATLAB

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include Math and computation Algorithm development Data acquisition Modeling, simulation, and prototyping Data analysis, exploration, and visualization Scientific and engineering graphics Application development, including graphical user interface building. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar no interactive language such as C or FORTRAN.

MATLAB PROGRAM

```

clc
disp('DESIGNING OF INDEXING DRILL JIG ');
fprintf("\n");
disp('STEP.1 SELECTION OF LONG SLIP BUSH:');
fprintf("\n");
b1 = ('VALUE OF DIAMETER OF HOLE TO BE DRILLED');
disp(b1);
b2=(' d1 ');
disp(b2);
b21=(' 3.3-4.0 ');
disp(b21);
b22=(' 4.0-5.0 ');
disp(b22);
b23=(' 5.0-6.0 ');
disp(b23);
b24=(' 6.0-8.0 ');
disp(b24);
b25=(' 8.0-10 ');
disp(b25);
b3=(' 10-12 ');
disp(b3);
b4=(' 12-15 ');
disp(b4);
b5=(' 15-18 ');
    
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```

disp(b5);
b6=(' 18-22 ');
disp(b6);
b7=(' 22-26 ');
disp(b7);
b8=(' 26-30 ');
disp(b8);
b9=(' 30-35 ');
disp(b9);
b10=(' 35-42 ');
disp(b10);
b11=(' 42-48 ');
disp(b11);
b11=(' 48-55 ');
disp(b11);
b12=(' 55-63 ');
disp(b12);
fprintf('\n');
fprintf('\n');
dgroup= input ('STEP.1 Enter diameter of the hole to be
drilled \n');
switch dgroup
case {1.0,3.2}
d2= 0.1; d3=0.1; L1=0.1; L2=0.1;
case {3.3,3.9}
d2 = 7; d3=11; L1 =08; L2 =06;
case {4.0,4.9}
d2 = 8; d3=12; L1 =08; L2 =06;
case {5.0,5.9}
d2 = 10; d3=14; L1 =10; L2 =07;
case {6.0,7.9}
d2 = 12; d3=16; L1 =10; L2 =07;
case {8.0,9.9}
d2 = 16; d3=20; L1 =12; L2 =08;
case {10,11}
d2 = 18; d3=22; L1 =16; L2 =20;
case {12,13,14}
d2 = 25; d3=26; L1 =16; L2 = 12;
case {15,16,17}
d2 = 25; d3=30; L1 =16; L2 = 12;
case {18,19,20,21}
d2 = 30; d3=35; L1 =20; L2 = 15;
case {22,23,24,25}
d2 = 36; d3=41; L1 =20; L2 = 15;
case {26,27,28,29}
d2 = 42; d3=47; L1 =20; L2 = 15;
case {30,31,32,33,34}
d2 = 48; d3=55; L1 =25; L2 = 20;
case {35,36,37,38,39,40,41}
d2 = 56; d3=63; L1 =25; L2 = 20;
case {42,43,44,45,46,47}
d2 = 63; d3=70; L1 =32; L2 = 25;
case {48,49,50,51,52,53,54}
d2 = 70; d3=77; L1 =32; L2 = 25;
case {55,56,57,58,59,60,61,62,63}
d2 = 80; d3=87; L1 =36; L2 = 30;
end
disp ('The values for slip bush are as follows:');
fprintf('d2=%0.2f d3=%0.2f L1=%0.2f
L2=%0.2f\n',d2,d3,L1,L2);
fprintf('\n');
fprintf('\n');

```

```

disp('STEP.2 THICKNESS OF JIG PLATE');
disp('NOTE: Here thickness of jig plate is equal to length
L1 of drill bush');
thickness =(L1);
fprintf('\n')
disp ('Thickness of jig plate is :');
fprintf('L1=%0.1f \n',L1);
fprintf('\n');
fprintf('\n');

```

```

disp('STEP.3 LENGTH OF JIG PLATE');
% Here according to component drawing Length of work
piece is 60 mm.;
% Here 8 mm. clearance is taken for indexing drill jig
length calculation;
Length = (2*L1+60+8);
fprintf('\n');
disp('Length of jig plate is:');
fprintf('Length=%0.2f \n',Length);

```

```

fprintf('\n');
disp('STEP.3 HEIGHT OF JIG PLATE');
% Here according to component drawing height of work
piece is 40 mm.;
% Here 4 mm. clearance is taken for indexing drill jig ;
Height = (40+L1+4);
fprintf('\n');
disp('Height of jig plate is:');
fprintf('Height=%0.2f \n',Height);

```

## RESULT

Below figure shows completely fabricated angular post jig



**Figure 5.** Fabricated Angular post jig (Snap 1)



**Figure 6.** Fabricated Angular post jig (Snap 2)

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### CONCLUSION

- The standardization of jigs makes the improvements in the existing system, and reduces the cycle times and improves the productivity.
- It simplifies the locating and clamping methods and shows the reality between the design drawings and existing parts physically in the shop floor.
- By simplifying the structure profile the cost of the jigs is reduced.
- Standardization improves the productivity day to day by doing improvements in the existing jigs.
- The improvements in the existing systems allow the less skilled operators to work at the workstation in the shop floor.
- By decreasing the cycle times and productivity improvements the machining cost of the components is reduced.

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