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CAPACITOR LEAD FORMING

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Abstract -To design and develop a lead forming die machine that efficiently and accurately shapes electronic component leads, ensuring precise bending and forming according to industry standards. The machine should be capable of handling various lead configurations, sizes, and materials, optimizing the manufacturing process for electronic components while maintaining cost-effectiveness and reliability. With very few pre-existing designs for automated lead forming devices, we essentially had come up with a design. To make our machine design as simple as possible, we decided to make it primarily using punch and die. The need for ever-changing process innovations is persistently fuelled by rapid technology advancements and demands on organizations to improve their bottom line. The design of the machine can be one in various ways

Key Words: design, develop, effective, accurate shape, Configuration, cost.

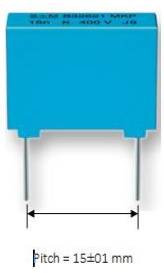
1. INTRODUCTION

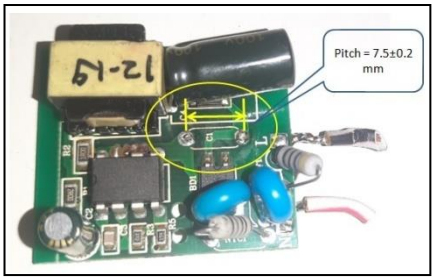
When the lead spacing of a capacitor does not match the hole spacing on PCB, the capacitor should have its leads formed to avoid exposing the capacitor to excessive mechanical stress. It's to space the capacitor up off the board so that undue stress is not placed on the ends of the capacitor (for example, if the lead spacing in the board holes is not exactly the same as the lead spacing on that particular capacitor, or if the thermal coefficient of expansion is different from that of the PCB). You should also avoid bending the leads of your capacitor right next to the capacitor body itself - the internal connections from a capacitor's leads to its actual capacitive material are delicate and can easily be damaged. Leave at least a millimeter or two between the capacitor body and the first bend in your leads to avoid breaking those delicate connections.

2. PROBLEM STATEMENT

With betterment in the chip technology, PCB designs have gone through significant changes in terms of size and shape. These changes have led to exponential demand for optimum performance in a compact form factor, thus challenging the conventional methodologies of the PCB design techniques. During the circuit design phase, finding the best way to use the allotted space for layout requires crucial decisions in many aspects. These decisions will have a large effect on the quality of the product throughout its lifetime. Hence, PCB routing constraints are one of the foremost factors in PCB technology which add a lot of value to the design.

Subsequently, miniaturization is evident across all industries and creates new design challenges for engineers tasked with fitting solutions in space-constrained designs. Thus, designer should ensure that there should be no compromise in the desired output of the electrical circuit and PCBs, while solving the problems of space constraints.





3. LITERATURE REVIEW

In Industries there are many options available for forming of capacitor lead which is manual lead forming tool which is inaccurate, time consuming and rejection rate of capacitor is high. Semi-automatic and fully automatic machines of lead forming. Forming of capacitor lead with manual tool may have face issues like lead coating damages and improper shape of both lead. The leads are not formed symmetrically. This will lead to improper mounting of capacitor on PCB. Damage of lead coating may lead to week soldering.

Semi-automatic and fully automatic machines which are available in market are costly and required more space for operation. In the present condition many manufacturing plant have facing space constraint issue due to which accommodation of space for new machine is very difficult situation for manufacture.

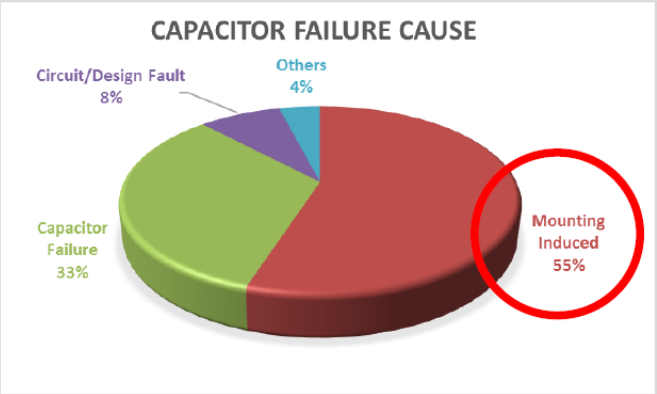


Fig -1: Figure

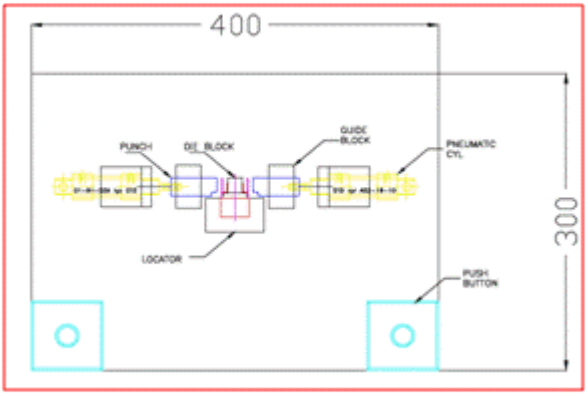
According to end customer survey mounting related induced failures are the number one reason (over 55%) for the field application capacitor failure causes. A careful evaluation of mounting guidelines and follow up in real assembly processes per the component manufacturers' recommendations shall be considered as a critical characteristic. Many times mounting process is the worst electrical and mechanical stress in the component's life. Failure Analysis of film capacitors usually involves:

1) Corrosion to the metalized film
2) Electrical overstress, solder stresses or mechanical damage.

4. CONSTRUCTION

A typical die and punch set used for forming operation is shown below. The punch which is held in the punch holder is bolted to the mounting bracket while die is mounting on the base plate. During the working stroke, the punch penetrates the lead wire.

Type of Punch and dia is compound dia that combines the principles of the conventional and inverted dies in one station. This type of die may produce a work piece which is pierced and blanked at one station and in one operation. The piercing punch is fastened in the conventional position to the punch holder.



5.DESIGN CALCULATION

Design of Capacitor Lead forming machine by using Pneumatic Actuator.

Useful input data: -

Force on base frame (F) = 78.48 N

Length of base plate= 420 mm

Length of supporting plate=146 mm

Width of base plate (b) = 300 mm

Thickness of base plate= 6 mm

Thickness of supporting plate= 16 mm

There are various Pneumatic Actuators used for various purposes, but this is special purpose machine which is only used for base frame having 49 N force.

Force Calculations:

- Cylinder thrust for double acting in forward stroke

F= (π/4) × ×P

D-Diameter of bore = 16mm

d- Piston rod diameter= 6mm

P-pressure = 5 Kg/cm²

= 490332.5 N/ cm²

F (forward stroke) = (π/4) × 16²×490332.5N/

F=98.58N

- Cylinder thrust for single acting in return stroke.

F= (π/4) × (D – d) ²

F= (π/4) × (16– 6) ² F = 78.53 N

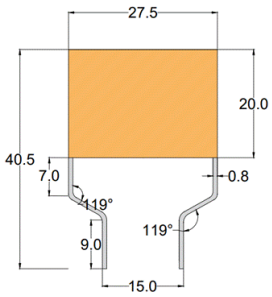
6. RESULT

With the application of pneumatic air we can formed any size of capacitor lead accurately and precisely.

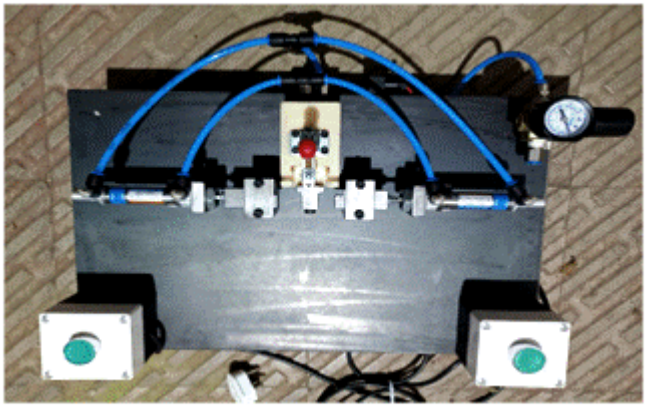
Pitch with straight leads: 27.5±0.2 mm

Pitch after lead forming: 15±0.2mm

Sr No	Height (Left Terminal)	Height (Right Terminal)	Pitch after lead forming
1	40.4	40.4	15.0
2	40.4	40.4	15.05
3	40.3	40.3	15.00
4	40.4	40.4	15.00
5	40.3	40.3	15.01



7. FINAL ASSEMNLY OF MODEL.



8. CONCLUSION

Wire forming process uses several different metals including stainless steel, steel, aluminium, copper, brass, and alloyed metals. We have successfully demonstrated the concept of lead forming by pneumatically operated punch and dia mechanism. There is an endless variety of wire forms, which increases regularly as new uses and applications are developed.

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