

Design of Special Fixture for Spool Body Testing

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Abstract: Spool is precision part used on dispensing machines. This should be manufacturing with high precision and accuracy. Hence the special type of fixtures are used. The project on 'Design of Special Fixture For Spool Body Testing'. which is sponsored by 'Twin Engineers Pvt. Ltd. Bhosari'. Fixture is designed and developed for checking spool body testing. Previously single spool double spool and three spool increasing setting time of testing and errors. Spool is used for different operation like filling, vacuuning and leveling. In this project single spool, double spool and three spool can be checked on single fixture simultaneously. Fixture is designed in such a way that it can accommodate different spools. This fixture reduces the time for checking and the errors. In addition cost of inventory of different fixture for spool testing is reduces.

Keywords: Fixture, Pillar, spool.

1. INTRODUCTION

Oil filling gun as shown in below fig.1 is used to fill the oil in various automobile parts such as brakes, engines, radiator coolant, clutches, gear box etc.

The gun may be a single/double/triple spool gun. The gun used in this process is generally a 3 spool gun. It consists of three spools namely - vacuum spool, filling spool, leveling spool. Each spool performs a specific functions assigned to it. In the conventional oil filling machines there are chances of dripping of fluid. In order to avoid dripping of fluid a special purpose machine is used called as oil filling gun. This gun helps to fill the exact amount of fluid (generally oil) required in automotive parts precisely and accurately.

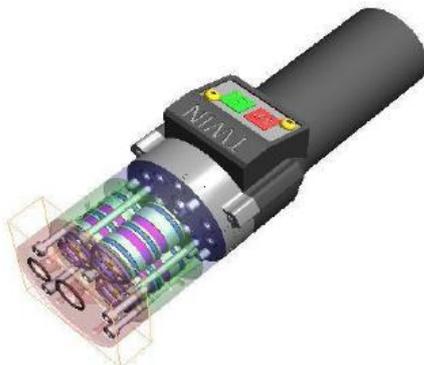


Fig 1. Three spool Body

There are three processes done by the dispensing gun

1.1 Evacuation

1.1.1 Vacuum

In this process air is been sucked out using the single stage rotary vacuum pump from the test setup. Vacuum pressure may be about 5-6 bar.

1.1.2 Vacuum Hold

In this stage, after sucking the air from the test setup there is a dwell (hold) period. This stage is been carried out for 5-6 sec. We check whether there is any leakage in the gun by using soap water. Pouring the soap water on the gun, if we see air bubbles on the gun we ensure that there is some leakage.

1.1.3 Re-Vacuum

After analyzing the leakage problem we carry out the process again to check the leakage. If there is no leakage we go to the next step some cases we are unable to detect the leakage, in that case we check each part by disassembling the gun. Also in some cases due to low pressure (1-2 bar) we are unable to detect leakage, so we carry out this test at maximum pressure (5-6bar).

1.2 Filling:

After finishing the evacuation process we start the filling process. There are mainly two ways for oil filling.

- Quantity based oil filling.
- Pressure based oil filling.

We carry out filling procedure as following: Vacuum closed and filling valve open: If we do not find any leakages in gun, then we start the filling process. We fill the oil according to the customer's need that can be quantity based or pressure based. Folling are the examples. For the gear box flow rate is about 20-30 lit/min. For radiator coolant filling about 40 lit/min. For 2-wheelers 60 sec and for 3 and 4 wheelers 100 sec.1

1.2.1. Filling hold:

We carry out this process to keep filling valve open to ensure that desired amount of oil should be filled in the tank.

1.3 Leveling Process:

In this process after filling the oil in tank, the desired level of oil is maintained by leveling process. When the oil level is low compared to required level then the oil filling valve opens and the oil is filled and acquires the required level. If the level is more than the customer requirement then the oil is sucked out and

2. LITERATURE SURVEY

2.1 A review on design and analysis of work holding fixture:

The design of a fixture is a highly complex and intuitive process, which requires knowledge. Fixtures are the tool used to locate and hold the work piece in position during the manufacturing process. Fixtures are used to hold the parts firmly which are to be machined, it is used to produce the duplicate parts accurately. In order to produce parts with required accuracy and dimensions the parts must be firmly and accurately fixed to the fixtures. A fixture is designed and built to hold, support and locate the work piece to ensure that each work piece is machined within the specified limits. Set blocks, feeler or thickness gauges are used in the fixture to refer the work piece with the cutter tool. It reduces or sometimes eliminates the efforts of marking, measuring and setting of work piece on a machine and maintains the accuracy of performance. The work piece and tool are relatively located at their exact positions before the operation automatically within negligible time. So it reduces product cycle time. Variability of dimension in mass production is very low so manufacturing processes supported by use of jigs and fixtures maintain a consistent quality.

2.2 An advanced exploration on fixture design:

The component or assembly that holds a part undergoing machining, must be designed to fit the shape of that part and the type of machining being done. A fixture is a device for locating, holding and supporting a work piece during a manufacturing operation. Fixtures are essential elements of production processes as they are required in most of the automated manufacturing, inspection, and assembly operations. Fixtures must correctly locate a work piece in a given orientation with respect to a cutting tool or measuring device, or with respect to another component, as for instance in assembly or welding. Such location must be invariant in the sense that the devices must clamp and secure the work piece in that location for the particular processing operation.

Fixtures are normally designed for a definite operation to process a specific work piece and are designed and manufactured individually.

1. Low variability in dimension, thereby leading to consistent quality of manufactured product
2. Cost reduction
3. Ensures interchange ability and high accuracy of parts.
4. Reduces the need for inspection and quality control expenses.

2.3 A review on design of fixture

In machining fixtures, minimizing work piece deformation due to clamping and cutting forces is essential to maintain the machining accuracy. The various methodology used for clamping operation used in different application by various authors are reviewed in this paper. Fixture is required in various industries according to their application. Fixtures reduce operation time and increase productivity and high quality of operation is possible. The fixture is a special tool for holding a work piece in proper position during manufacturing operation. For supporting and clamping the work piece, device is provided. Frequent checking, positioning, individual marking and non-uniform quality in manufacturing process are eliminated by fixture. This increases productivity and reduces operation time. Fixture is widely used in the industry practical production because of feature. The efficiency and reliability of the fixture design has enhanced by the system and the result of the fixture design has made more reasonable. To reduce cycle time required for loading and unloading of part, this approach is useful. If modern CAE, CAD are used in designing the systems then significant improvement can be assured.

3. PROBLEM STATEMENT

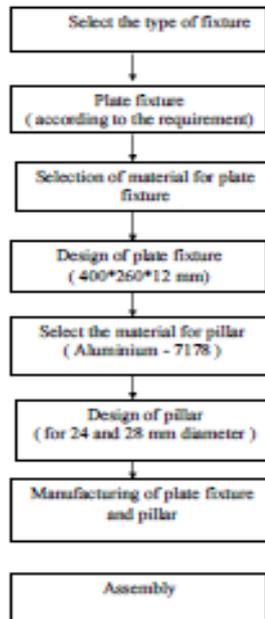
In previous testing they use different type of gauges for checking the dimensions it takes long time therefore operator may have some fatigue therefore human error occurs. Also other types of problems like improper alignment, less accuracy are also affected on the product. In this process other parameters like perpendicularity, ovality cannot be measured.

4. METHODOLOGY

4.1 Dispensing gun:

Dispensing gun contains number of components like pipe spool body compressor, vacuum pump, pressure

gauge. Mainly three types of spool are used. Single body spool, double body spool and three body are the main component of dispensing gun.



$$7.8*12*0.4*0.256=9.734\text{kg}$$

9. Material for pillar: Aluminum

$$10. \text{Weight of pillar-for 24mm diameter}=2.5104\text{kg}$$

$$\text{For 28mm diameter}=1.70694\text{kg}$$

11. Material for handle: Polyamide

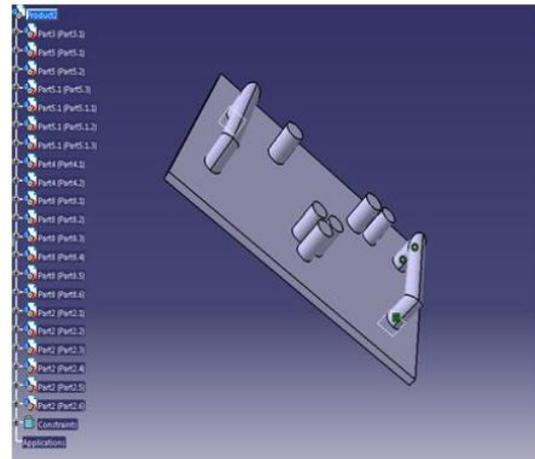


fig 2: Assembly of Fixture Plate

5. DESIGN AND DRAWING

Specification of fixture:

- Total length of fixture= 400 mm
- Total width of fixture= 260 mm
- Total thickness of fixture= 12 mm
- Diameter of single spool= $28^{+0.03}$
 $+0.02$
- Dimension of double spool body:
Diameter of 1 spool= $24^{+0.03}$
 $+0.02$
Diameter of 2 spool= $28^{+0.03}$
 $+0.02$
- Diameter of three spool body:
Diameter of 1 spool= $24^{+0.03}$
 $+0.02$
Diameter of 2 spool = $24^{+0.03}$
 $+0.02$
Diameter of 3spool= $28^{+0.03}$
 $+0.02$
- Material for fixture plate: Mild Steel
- Weight of the fixture plate=
density*thickness*width*length

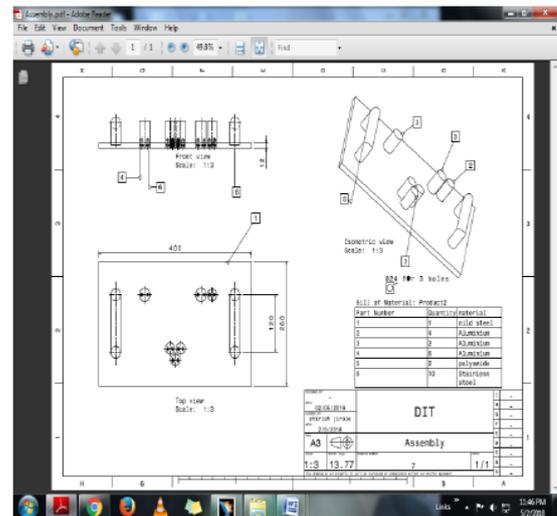


Fig 3: Drafting of Assembly

6. ESTIMATION OF COST

Sr no	Processes and parts	Material	Cost(Rs.)
1	M.S. Plate	A36 Steel	3000
2	pillars	Aluminium 7178	4800
3	Flash chrome plating	-	1000
4	Machining cost	-	1000
5	Bolts and dowel pins	Stainless steel	300
6	handles	Polamide	400

7. RESULTS AND CONCLUSION

At present there is single fixture for testing of spool body. Spool is used for filling the oil in mechanical parts. Currently, This fixture is used for easily check the spool body as well as to reduce the error at a time of checking. We reduced the time for checking of spool body. This fixture used to improve reliability and reduce testing time by using this fixture.

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