ABSTRACT

In this paper, a simplified approach of Design of Inspection Fixture which is one easiest way to inspect the mass production of automobile component. Inspection Fixture is used to check the area of the component occupied and its every needed point, the position of holes and its dimensions profile tangency of surface and shrinkage of the part also can be check in the inspection fixture. Loading of the part can be easily done with the inspection fixture as same like its fitment in vehicle with its surrounding and it can be easily unload. The chances of the part damage while unloading is none with the inspection fixture. This fixture is light weighted and can be easily transferred everywhere. This is the most adopted way of checking the components in automobile industry as it is affordable to everyone.

Keywords: Design, Manufacturing, Cmm Analysis, Inspection.

I. INTRODUCTION

In this project customer demanded a solution to his moulded plastic part problem, his query is about checking feasibility of the mass production parts with its mating, while actual fitting in vehicle. Is the flush of surface and trim of the edge is smooth and as per the standard for fitting and visual purpose?

My vision is to settle the queries and find the permanent feasible solution for his mass production. So I searched for this and found the concept of ‘Inspection Fixture’ and started to work on this.

As per the customer demands in this inspection fixture we provided the fixture body to check the trim edge gap along tis periphery and flush of the surface adjacent to the trim edge. Also the locking of part with is mating provided by using mechanism, locator and insert. And for checking some of the point as per customer specification we provided dial checking specification.

II. BACKGROUND & HISTORY

It is very difficult to check the newly moulded part by fitting with its original mating data. If there is a problem with newly moulded part and if it fitted with its mating then while removing it there is a large probability of damaging mating and newly moulded part.

A vehicle has many subparts in its assembly so it is also not possible to check every part by fitting with its original mating data.

For this purpose a concept of Inspection fixture has invented. In inspection fixture actual fitting using mating data can be provided by making it movable and removable with the concept of mechanism, slider, locator, insert, clamp, removable locking pin, removable checking pin, also the flush and trim can be check by providing uniform fixture body.

III. INSPECTION FIXTURE DESIGN

Design of Inspection Fixture

The three dimensional Parts of an inspection fixture designed by using CATIA V5 R26 software. The following steps show the construction of inspection fixture parts by using different tools. After designing the inspection fixture it looks like as shown in figure.

The fixture is to be a special tool for holding and checking a moulded part in desire position during inspection operation. For the supporting and clamping the part, gauge is provided. Common checking, positioning, individual marking and non-uniform quality in inspection process are to be eliminated by fixture show in Fig 1: inspection fixture.
This raises productivity and reduces process time. Fixture is mostly used in the industry for practical production because of their characteristic advantages. A fixture consists of a set of fixture body, locators, inserts, mechanisms and clamps. Locators are used to determine the location and orientation of a work piece, whereas clamps exert clamping forces so that the work piece is pressed resolutely against locators. Clamping has to be appropriately planned at the stage of machining fixture design. The design of a fixture is an extremely complex and illogical process, which require knowledge. Fixture design plays a significant role at the setup planning phase. In the present fixture the inspection of the product is carried out manually, which leads to problems of misalignment and inaccuracy. This inaccuracy will increase the rejection of components. In order to minimize this error and reduce the rejection, it becomes essential to design a special purpose auxiliary attachment to the existing fixture. By using this inspection fixture we inspect the edge gap, surface flush, fitment, slot position.

**A. Fixture body design:**

Inspection volume is for checking purpose. For checking 5 mm gap and 0 mm flush as per customer requirement we provided it. For specified area we offset the blue surface shown in fig.3 by 5 mm and gave it a large area for its strength and proper checking of 20 mm inside and 10 mm outside by tangent extrapolating and then we joint it for making a single gap surface. It is made up of aluminium material of grade 6061.
B. Removable Locators:
For locking the datum wherever components meet the surrounding data that area is the datum area, it means that area hold the part and lock the component. We have to make the clone of that area by extracting that surface of mating data. It is manufactured with stainless steel material with 304 grades.

C. Clamp & Fixed Locators:
Clamp is used to lock the perpendicular direction of part surface. At some datum part may locked with surrounding in such a way that it is not easy to unlock, ones it get locked the removable process may damage the part or surrounding data. In such a case if locking in inspection fixture is not possible then clamp locking is
to be provided. In this fixture material for locator we have used is of stainless steel of grade 304 and clamp is of standard size.

![Fig III.C.I: Datum locking by clamp & locator](image1.png)

![Fig III.C.II: Datum locking by clamp1 & locator1](image2.png)

![Fig III.C.III: Part with mating 1](image3.png)

**D. Inserts:**

We have cut the surrounding data and design it in such a way that there will be proper provision for locating and fixing the locator. This insert worked as both locator and inserts some area of this used for locating purpose and some of them for inserting it in component as shown in fig. In this fixture material for inserts we have used is of stainless steel of grade 304.

![Fig III.D.I: Datum locking by inserts](image4.png)

![Fig III.D.II: Datum locking by insert1](image5.png)

![Fig III.D.III: Part with mating 1](image6.png)
E. Mechanisms:
There may various types of mechanism provision can provided at the snap, in such a type locking done by pressing datum area. For such purpose locators and inserts cannot work, if we used it then removing of part not possible. For solving this issue concept of mechanism is the best solution. In this fixture material for mechanism we have used is of stainless steel of grade 304.

F. Dial Gauge Checking Points:
In 2D drawing of component there may have specified some points. It is for checking their position in vehicle orientation. While designing the component this points may have special properties of mechanical or visualisation. There are two types of dial gauges first one is to check the point surface and second one is to check line surface.
G. tooling Holes & Car lines:

Tooling holes are used to take the reference while checking the gauge in Coordinates Checking Machine (CMM). Any three tooling holes out of four can take for checking the fixture and this tooling holes can have some specific coordinates that is to be mentioned on coordinate plates kept near to the tooling holes, after finishing the work in CMM tooling holes closed by the reference bushes. For taking references while doing CMM reference can take by providing tooling holes or by providing reference bush, but in this fixture we have provided the tooling holes as shown in the fig. In tooling holes there may be a bush for reference and its material is of Stainless steel.

![Tooling holes & coordinates](image1)

![Car lines on baseplates](image2)

Car lines indicate the orientation of component along the axis in environment. On base plate we create the fine lines at the distance of 100 mm same like the vehicle orientation, it helps to guess and measure whether the component after locking is at orientation or not. Car lines also helps to find out the area of component under the every 100 mm distance it give us logic about the component feasibility visually.

Manufacturing of Inspection Fixture

For manufacturing we have used various operations and this are as follows.

A. CNC Machining:

CNC machining is stands for the Computer Numerical Control. CNC machining is a manufacturing process in which pre-programmed computer software dictates the movement of factory tools and machinery. The process can be used to control a range of complex machinery, from grinders and lathes to mills and CNC routers.

B. Wire Cutting:

Wire EDM machining (Electrical Discharge Machining) is an electro thermal production process where a thin single strand metal wire, along with de-ionised water (used to conduct electricity) allows the wire to cut through metal by the use of heat from electrical sparks, while preventing rust.

C. Drilling:

Drilling is done by the vertical drilling machine or by the M1TR machine. M1tr machine is the most preferable machine in industry line for machining. We have used this machine for drilling holes purpose.

IV. RESULTS AND DISCUSSION

After designing inspection fixture first step is to check its clashes and feasibility about manufacturing for better result. For accuracy purpose we inspect manufactured inspection fixture in the CMM that’s called as coordinate measuring machine. After completing these initial stages checking we finally inspect the molded part in the inspection fixture.

Checking of Clashes

Once we designed the inspection fixture we check the clashes and fouling in inspection fixture. It is very important part because due to fouling manufacturing time get disturbed as well as task of CMM we have to be rescheduled. Then redesigning, machining, cutting this operations are time consuming, thus due to clashes all the time schedule distributed.

For this problem there is a solution in all CATIA versions. In DMU Space analysis workbench, by using clash command we can check the all clashes in fixture. If we found any of them clashes harmful we can easily changes on the spot of designing and future problems get solved by this.
CMM Inspection

CMM of inspection fixture is very important, difficult and logical part in all operations. In this assemble of the inspection fixture happened, all the mistakes of design manufacturing get founded in this task. So persons of this task have the huge responsibility to do not skip the errors, thus this person's find out the every error to get the proper gauge as per the customer requirement.

After assembling and checking all the points of datum they make a report of that inspection fixture while dispatching it to the customer they demand it to them, so we have provided it to them while dispatching.

Checking the part

After finishing the entire task, customer provides us their part for inspection. After getting it, it’s our responsibility to check the part in inspection fixture. We have fixed this part in inspection fixture, then we measured the gap of 5 mm along the periphery of the part by using the tapered scale. Then we check the all dial point by using dial gauge, after that we insured that locking of the part is tight, that it doesn’t loose and vibrated.

We have shown this all process of fixing the component with inspection fixture in a video, and we have measured all the required points in it.

V. CONCLUSION

We know that actual fitting of the part in vehicle is the final task and then if we found the defect in component it is very difficult to remove the part as it can damage the part and surrounding. Inspection fixture is the best way to check the component fitment feasibility. This system proves as better & more efficient way to check the fitment and visualize effect after the fitment as its fitment is same as fitting in the automobile. We can same this gauge is the clone of the automobile fitment surrounding area. These kinds of inspecting gauge are necessary
for reducing the chances of damaging the part and time of inspection. Let us use these kinds of less cost, no accidental chances & no financial loss causes inspection fixtures.

VI. REFERENCES

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