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Design and Development of Checking Fixture for Sheet Metal Components

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ABSTRACT: Checking fixture is a tool used in the industries to check the quality and fitment of produced parts having irregular shapes. Based on the results of checking the part will be accepted or rejected for final assembly based on the dimensional accuracy. This paper will highlight approach towards design of checking fixture and its use in the mass production. Checking will include datum points and surfaces in the final fitment of assembly. The loading and unloading of part on the fixture should be easily done to avoid the damage and scratches on the final part. The validation of final checking fixture design will be done by CMM inspection.

KEYWORDS: Gap and Flush check, CMM inspection, datum, tooling holes.

I. INTRODUCTION

The fixture is special purpose tool used for holding the work piece in proper way during manufacturing and checking. The fixture consists of structure, clamping and locating devices which will increase the productivity and reduce operating time. The locators will locate the position and orientation of the part. And the use of clamps is to apply the clamping force against the locators. The design of fixture will play important role in initial planning and prototyping phase.

So the role of checking fixture in development of any new component is very important and crucial as checking fixture will avoid and minimize further corrections and modification in the final mass production. The fixtures are available in different sizes, shapes, materials and mechanisms as per need of operations. Fixtures must correctly locate a work piece in a given orientation with respect to a welding torch or measuring device, or with respect to another component. Whenever any component is in space it will have 6 degrees of freedom and for correct location of that component it is required to restrict those 6 degrees of freedom. These degrees of freedom can be restricted by 3-2-1 location system. 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.

The checking fixtures are generally used in the mass production where checking of the parts before final assembly will be checked thoroughly by using the tool. If the component meets the fixture requirements then the component will be accepted and if it shows any deviations after loading it on fixture body it will be rejected or sent for modifications.

The component taken here for study is oil tank of two wheeler and the design of same is created using CATIA V5 software and then sent for further manufacturing and developments.

II. FIXTURE DESIGN

The design of checking fixture and panel checkers is done on CATIA V5. Initially the data received from customer is inserted in the software and based on the datum holes and surfaces the design will be completed as per part data. Generally gap and flush method is used to check the part profile and outer boundary of the component. For supporting and clamping the supports and clamps are provided. Part loading and unloading should be easily done, based on the same the clamps and supports should be given.

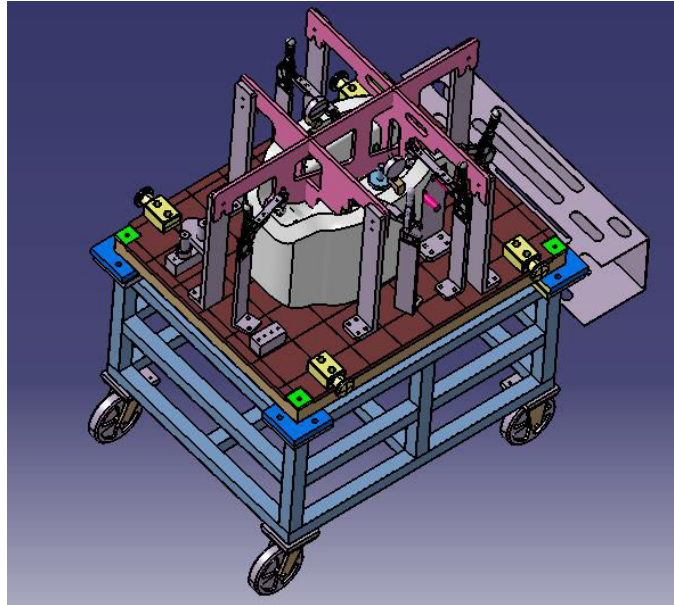


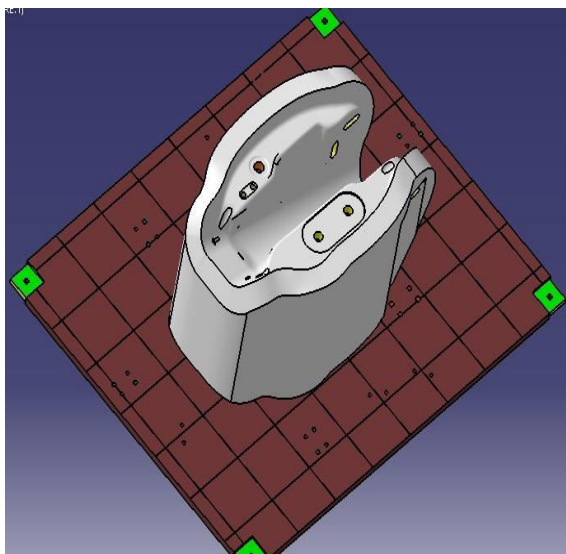
Fig. I- Checking Fixture

III. METHODOLOGY

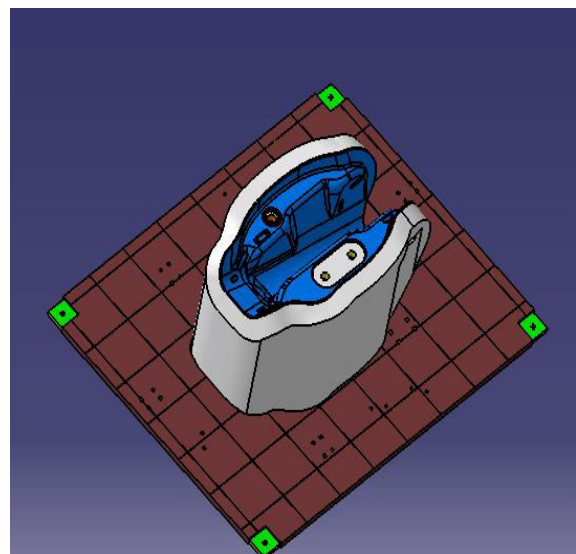
Detailed step by step procedure to design and develop the checking fixture is,

I. Fixture body design:

Initially as per part data received from customer B surface is extracted and used for designing the fixture body. A gap of 3mm is kept between Ciba body and actual part. Outer periphery and profile can be easily checked by gap and flush method. Fixture for fuel tank fixture is designed as shown in the fig. II and III. Generally the points considered during the design are datum points given by customer and datum surface given. The part resting should be on B surface.



Fixture Body without component



Fixture Body with component

Fig. II-Fixture body

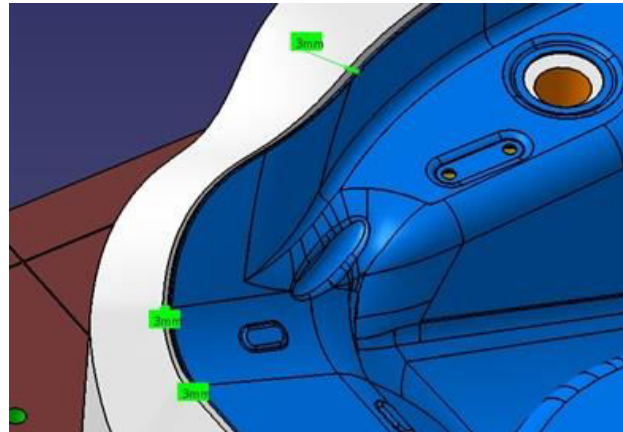


Fig. III- Gap Measurement

II. Locating and Clamping:

Locators are provided at the datum points to hold and position the part in its proper position. Two datum pins as shown in the fig. IV will lock the part and then clamping will be provided to check the dimensions.

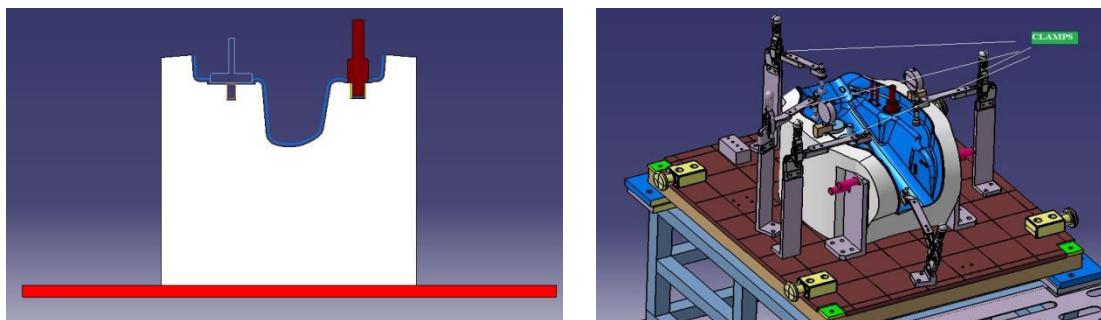


Fig. IV- Locating & Clamping arrangement

III. The profile of the component will be checked by templates provided as shown in the Fig. V. the gap of 3 mm is provided below the template throughout. The component is having two embosses and is checked by the inserts as provided.

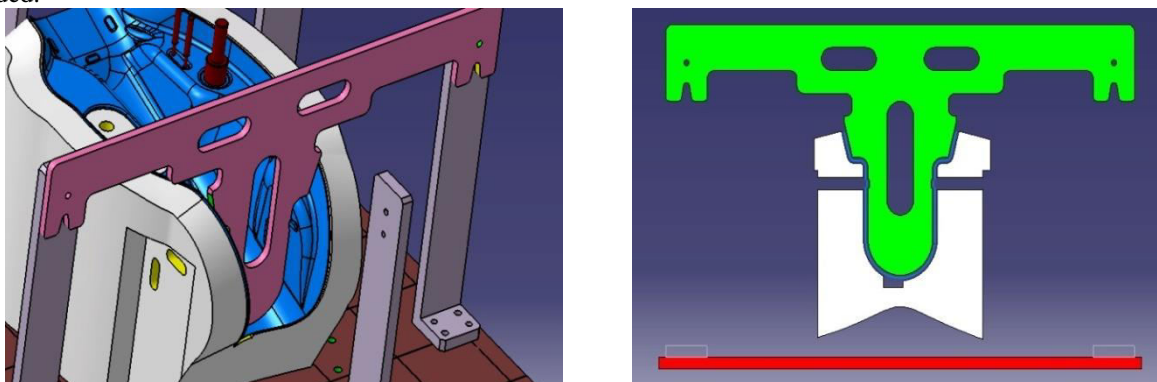


Fig. V. Templates for profile checking

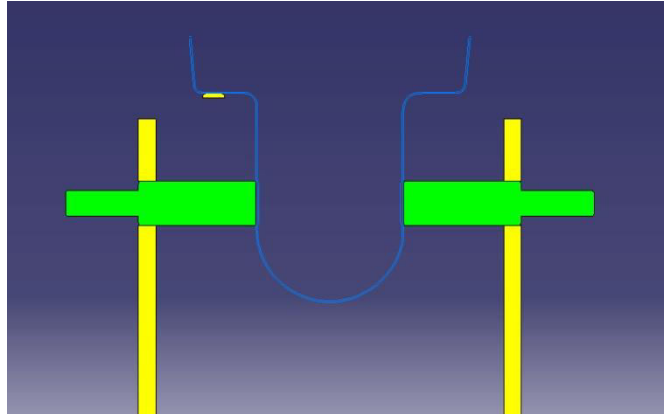


Fig. VI-Emboss Checking by Inserts

TOOLING HOLES & CARLINES:

The tooling holes are kept on the base plate for machining and CMM reference. If any further revisions in the component drawing happens then the machining and CMM inspection can be done by using the tooling hole references. While doing assembly of fuel tank, the carlines will play major role in fitting the part in its proper place. Also one can observe the deviations in the actual part as per carline zones and will be easy to detect and rectify the observed deviations during actual fitment.

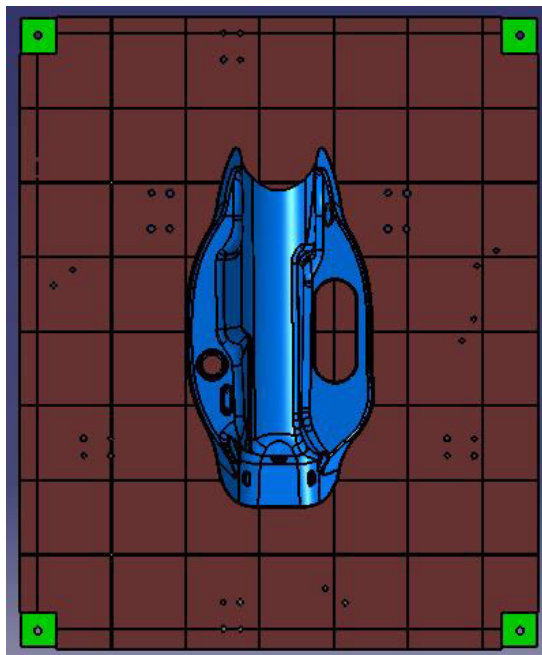


Fig. VII- Tooling holes & Carlins

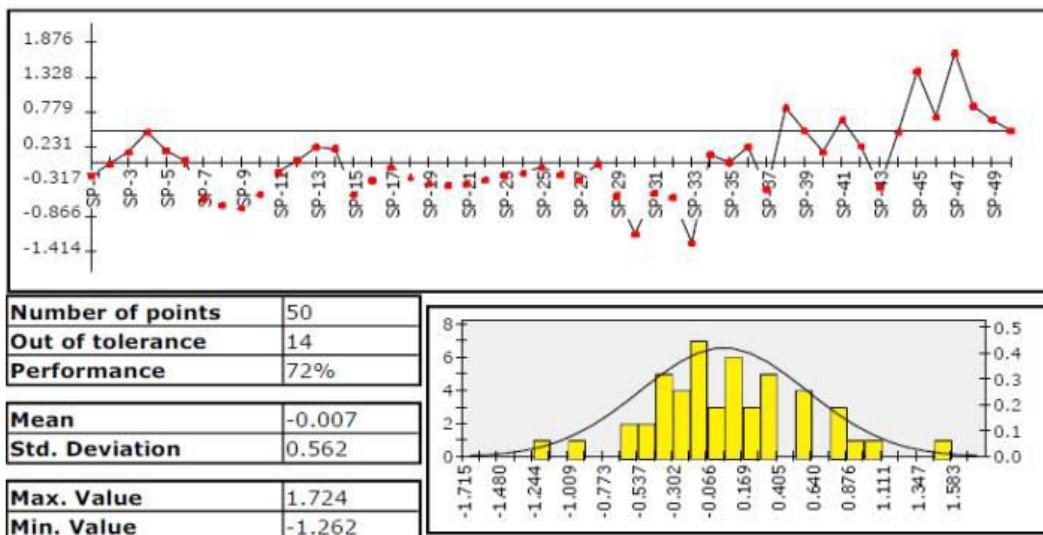
CMM REPORT:

After machining of the fixture body it is checked on the coordinate measuring machine whether the manufactured fixture is as per requirement and part data. The CMM inspection is carried out by taking the tooling holes as reference. The deviations observed in the CMM report should be within accepted limits. For current fixture of fuel tank, the CMM report is generated and sent with the fixture to the customer. Roamer CMM arm shown in the fig was used to check the dimensional accuracy of fixture and report is generated.



Fig. VIII-Romer CMM ARM 7325

So CMM report will validate that the fixture is as per provided data and can be used for mass production.



CMM Report

IV. CONCLUSION

The main aim of designing and manufacturing of checking fixture is to avoid the rejections of fuel tanks in the final assembly. The checking fixture will assure that produced part is as per our requirement if it fits well on the checking fixture, considering the gap and flush tolerances as per manufacturing drawing. So checking fixture will avoid the further hurdle in the assembly which will increase the productivity and reduces cycle time in effective way.

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