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Door Installing Fixture Of Car For Maintaining Gap And Flushness

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Abstract— Manufacturing a car is just not welding, painting and assembling. There are many complexities added to it. This section reviews about the development of fixture for installing a door to maintain the gap and flushness. A systematic approach is to be maintained to obtain the best door gap in automobile body manufacturing.

Index Terms— automobile, fixture, flushness, gap, mylers.

1 Introduction

Designers may wish to have no gaps and complete flush. But splits are required for obvious reasons to make engineering feasible. When two parts comes and sit on one place, gap and flushness of their interface must be defined. Maintaining gap is, as less and uniform as possible. Gaps are different at different interfaces and it might be only due to their limitations in production and assembly. Flushness visibility changes with surface geometry of the interface. Bigger radiur at the edges disguise variation visibility allow higher production tolerances.

As automobile body fit and finish is concerned, the door fit problems has been ranked as the top items due to high cost. The misalignment of the door on the car body will not only affect the asthetic value of the vehicle but also cause functional problems such as wind noise; water leakage as well as difficulty in closing the door i.e more effort will be required for closing the door. The dimensional variations of the gap and flush between a body-in-white (BIW) and doors, or between doors arise from variation of door hanging process, dimensional variations in the BIW openings and dimensional variations of door. This paper addresses the improvement of door hanging processes.

One of the major operations on the production floor is door hanging which may be manual or automatic. In case of manual operation, the door is positioned onto the BIW opening using hanging fixture, bolted with hinges and adjusted when necessary upon visual inspection. Adjustment can include twisting and bending of the floor or by moving the hinges. The problems associated with this are as follows:

1. Inconsistency in door fitment calls for the development of a systematic hanging fixture adjustment scheme.
2. The capability of correcting the gap deviations is not understood. Due to this the faults cannot be located for corrections.
3. Hammering operation is done for door fitting which leads to bending of hinges.
4. The correct procedure is not available for door fixture adjustment.
5. The current practice for door installation is time-consuming one.

2 Fixture development

A fixture frimary purpose is to create a secure mounting point for a workpiece, allowing for support during operation and increased accuracy, precision, reliability and interchangeability in the finished parts. Designing a correct fixture reduces the working time by allowing quick set-up, and by smoothing the transition from part to part. They also allow for a higher degree of operator safety by reducing the concentration and effort required to hold a piece steady. Economically speaking the most valuable function of a fixture is to reduce labour costs. Without a fixture, operating a machine or process may require two or more operators; using a fixture can eliminate one of the operators by securing the workpiece.

2.1 Process for Fixture Development

Fixtures must always be designed with economics in mind; the purpose of these devices is to reduce costs, and so they must be designed in such a way that the cost reduction outweights the cost of implementing the fixture. In designing the locating parts of the fixture, only the direction of forces applied by the operation are considered, and not their magnitude. The five step process involves:

i. Define Requirements: State the problems to be solved or the needs to be met. State these requirements as broadly as possible, but specifically enough to define the scope of the design project.
ii. Gather / analyze information: Collect all relevant data and assemble it for evaluation. Four categories of design considerations need to be taken into account at this time: workpiece specifications, operation variables, availability of equipment, and personnel. These categories, while separately covered here, are actually interdependent. Each is an integral part of the evaluation phase and must be thoroughly thought out before beginning the fixture design.
iii. Develop several options: This phase of the fixture-design process requires the most creativity. A typical workpiece can be located and clamped several different ways. The natural tendency is to think of one solution, then develop and refine it while blocking out other, perhaps better solutions. A designer should brainstorm for several good

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tooling alternatives, not just choose one path right away. The designer usually starts with at least three options: permanent, modular, and general-purpose workholding. Each of these options has many clamping and locating options of its own. The more standard locating and clamping devices that a designer is familiar with, the more creative he can be. Areas for locating a part include flat exterior surfaces (machined and unmachined), cylindrical and curved exterior surfaces, and internal features (such as holes and slots). The choice of standard locating devices is quite extensive. Similarly, there are countless ways to clamp a part, using a wide array of standard clamping devices. For example, a workpiece can be clamped from the top, or by gripping its outside edge or an internal surface.

iv. Choose the best option: The fourth phase of the tool-design process is a cost/benefit analysis of different tooling options. Some benefits, such as greater operator comfort and safety, are difficult to express in dollars but are still important. Other factors, such as tooling durability, are difficult to estimate. In analyzing fixture costs, the emphasis is on comparing one method to another, rather than finding exact costs. Estimates are acceptable. Sometimes these methods compare both proposed and existing fixtures, so that, where possible, actual production data can be used instead of estimates. To evaluate the cost of any workholding alternative, first estimate the initial cost of the fixture. To make this estimate, draw an accurate sketch of the fixture. Number and list each part and component of the fixture individually. Here it is important to have an orderly method for outlining this information. The next step is calculating the cost of material and labor for each tooling element. Once again it is important to have an orderly system for listing the data. First list the cost of each component, then itemize the operations needed to mount, machine, and assemble that component. Once those steps are listed, estimate the time required for each operation for each component, then multiply by the labor rate. This amount should then be added to the cost of the components and of the design to find the estimated cost of the fixture.

v. Implement the design: The final phase of the fixture-design process consists of turning the chosen design approach into reality. Final details are decided, final drawings are made, and the tooling is built and tested. The following guidelines should be considered during the final-design process to make the fixture less costly while improving its efficiency. These rules are a mix of practical considerations, sound design practices, and common sense. Use standard components: The economies of standardized parts apply to tooling components as well as to manufactured products. Standard, readily available components include clamps, locators, supports, studs, nuts, pins, and a host of other elements. Most designers would never think of having the shop make cap screws, bolts, or nuts for a fixture. Likewise, no standard tooling components should be made in-house. The first rule of economic design is: Never build any component you can buy. Commercially available tooling components are manufactured in large quantities for much greater economy. In most cases, the cost of buying a component is less than 20% of the cost of making it. Labor is usually the greatest cost element in the building of any fixture. Standard tooling components are one way to cut labor costs. Browse through catalogs and magazines to find new products and application ideas to make designs simpler and less expensive. Use prefinished materials: Prefinished and preformed materials should be used where possible to lower costs and simplify construction. These materials include precision-ground flat stock, drill rod, structural sections, cast tooling sections, precast tooling bodies, tooling plates, and other standard preformed materials. Including these materials in a design both reduces the design time and lowers the labor cost. Eliminate finishing operations: Finishing operations should never be performed for cosmetic purposes. Making a fixture look better often can double its cost. Here are a few suggestions to keep in mind with regard to finishing operations. Keep tolerances as liberal as possible: The most cost-effective tooling tolerance for a locator is approximately 30% to 50% of the workpiece's tolerance. Tighter tolerances normally add extra cost to the tooling with little benefit to the process. Where necessary, tighter tolerances can be used, but tighter tolerances do not necessarily result in a better fixture, only a more expensive one. Simplify tooling details: Elaborate designs often add little or nothing to the function of the fixture. More often, a power clamp can do the same job at a fraction of the cost. Keep the function and operation of a fixture as simple as possible. The likelihood of breakdowns and other problems increases with complex designs. These problems multiply when moving parts are added to the design. Misalignment, inaccuracy, wear, and malfunctions caused by chips and debris can cause many problems in the best fixture designs.

2.2 Use of Mylers (Adjustment Blocks)

Mylers are standard yet versatile parts that are used with locating pins, rest pads, jig feet, and other parts in a fixture. Mylers can be ordered with different hole configurations such as tapped holes, drilled and counter bored holes, press fit dowels, or slip fit dowels. When Mylers are counter bored, the counter bore is on both sides of the block. The designer can then flip the block around to meet different needs and spacing constraints. Mylers can have holes in both ends of the block or only one end. A myler with holes in only one end leaves room for the machine designer to modify or customize the end of the block without holes.

2.3 Controlling the Gap and Flushness

It is very necessary to control the deviations in all the three axis for proper installation of the door with respect to BIW. The following figures shows the provisions of ribs in the myl-

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ers to maintain the gap between the door and BIW as per the company standards.

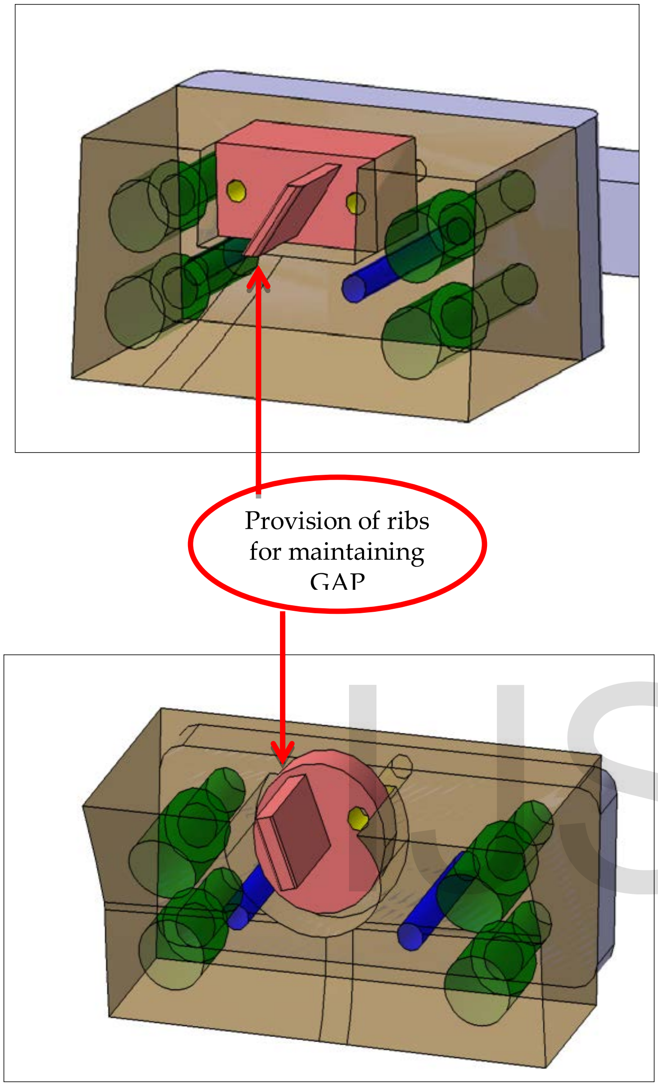

Figure 1: Myler with ribs

These ribs are either press fit or fixed with screws. Due to continuous operation of the fixture the is a possibility of tearing and wearing of the ribs. So, the entire myler needs to be replaced. To avoid this the separate rib assembly has been made. This concept also reduces the cost of replacing the entire mylers.

3 Conclusion

The door-fitting problem was formulated as a constrained optimization problem. Two indexes: door gap width deviation relative to design nominal and door gap parallelism were defined to evaluate the door gap quality quantitatively. The quality of the gap is influenced more by the variation of the door (and the openings) than by the average deviation. Therefore, reducing the variation of the door is important to obtain quality gap. Fitting individual doors to the door openings can improve the quality of fit. Batch-to batch door fit can only correct for process mean deviations. The size of the designed nominal gap should be process driven. The smaller the nominal gap, the more capable the door manufacturing processes should be.

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