CENTRIX ROUND BODY EXPANDING PIN FASTENER (RB-EX) PRESENTATION – CONSTANT ALIGNMENT FASTENER FOR THE AEROSPACE MANUFACTURING INDUSTRY

INTRODUCTION

The Round Body Expanding dowel is designed to maintain alignment in the production of aircraft components. The expanding dowel has evolved from how a conventional dowel works. Conventional dowels are generally manufactured from a silver steel type material and are produced to offer at best a transitional fit to the product that it is designed for.

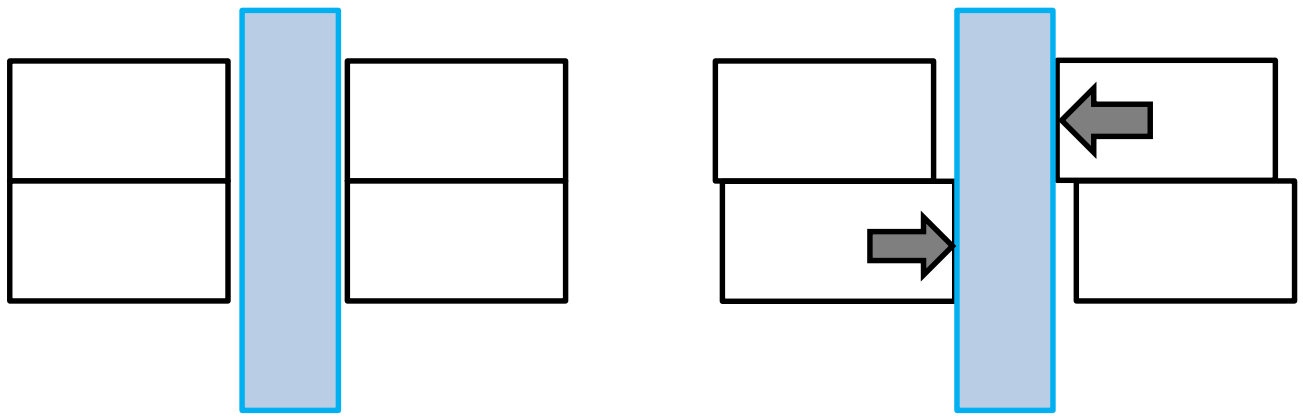
The issue with conventional aircraft build, is that within any drilling process, there is always a tolerance. For example, a dowel must be manufactured to the lowest hole diameter possible, in the case of a 3/8” it would be 0.375”. The largest the dowel could be manufactured too is 0.375” and this too will have a tolerance, perhaps 0.0005”. The hole tolerance might then be 0.002”, meaning a worst case scenario is that the dowel is -0.0025” smaller than the hole that has just been drilled. This could mean therefore a case of misalignment within the build process is still possible.

The RB-EX has therefore been designed and manufactured to remove this problem from aircraft manufacture, in that the RB-EX is manufactured to be smaller than the hole that is drilled, but expands with torque application to fill the hole that is drilled, ensuring constant alignment is maintained. The following slides explains the benefits of using an RB-EX within your manufacturing facility

FUNCTIONALITY OF THE RB-EX

The RB-EX is designed to ensure that alignment within the build of the aircraft structure is maintained consistently. It also aids in the areas of shear stress that can exerted on fasteners / aircraft structure during the assembly processes.

When the clamp load friction is not sufficient to counter the shear load, the fasteners will become mechanically loaded in shear. Conventional dowels in their properties must be manufactured smaller than the hole it is designed for. With this, the structure will have the possibility to shift, causing misalignment which can cause undue shear stress on the aircraft structure or cause further issues when drilling further along the structure. Figure 1 below shows an example of this with a solid conventional dowel.

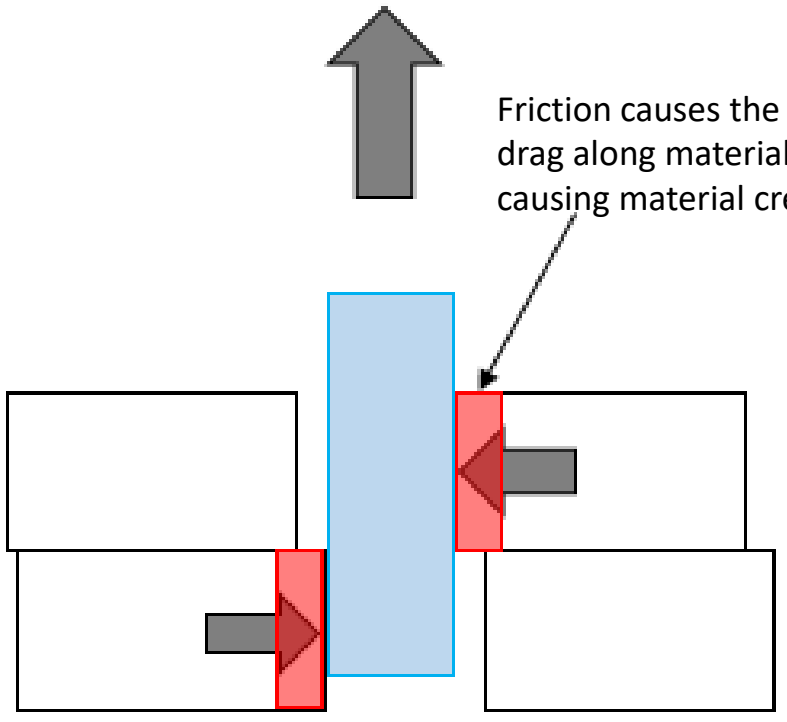


Doweling pin in unloaded hole Doweling pin in shear loaded hole

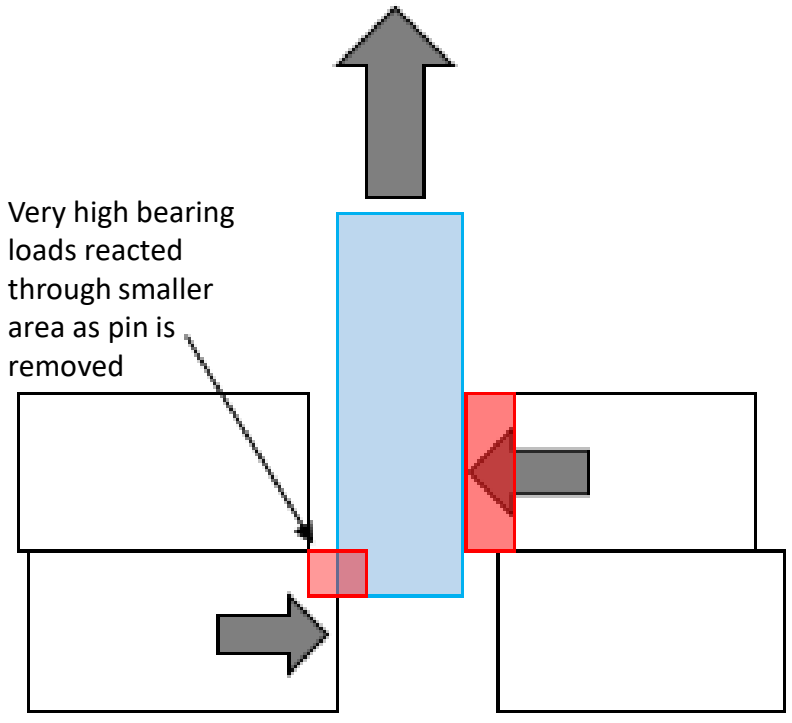
Figure 1

FUNCTIONALITY OF THE RB-EX

When a solid dowel is removed from the hole that it has been installed in, the frictional forces can sometimes prevent the dowel from being removed easily. A percussive force is sometimes required to remove the dowel from the hole, potentially causing damage to the structure and the pin.



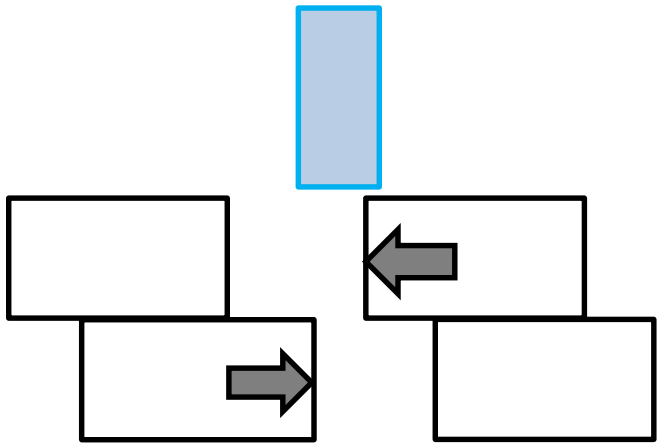
Dowling pin being removed from shear loaded hole



Dowling pin being removed from shear loaded hole

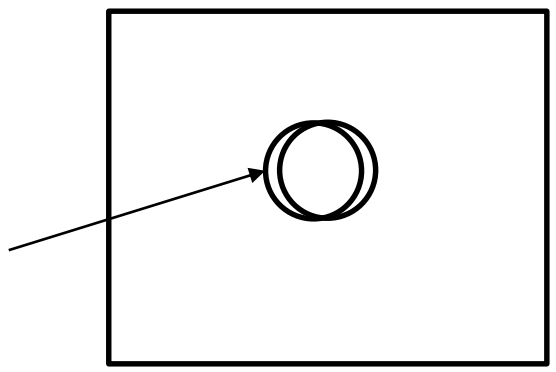
FUNCTIONALITY OF THE RB-EX

Once the dowel has been removed, the shear loads of the structures will cause the material to continue to shift. This will cause additional panel misalignment which can require a secondary process to allow the final fastener to be inserted, such as reaming.



Material shift after pin is removed

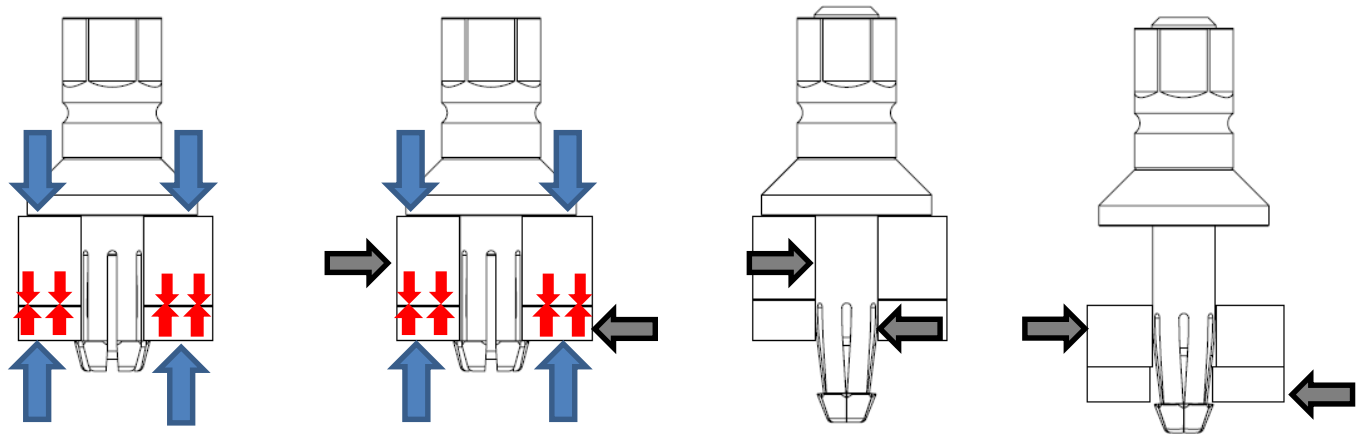
Misalignment in final hole may require reaming in order to insert final fastener.



Top View of misaligned hole

FUNCTIONALITY OF THE RB-EX

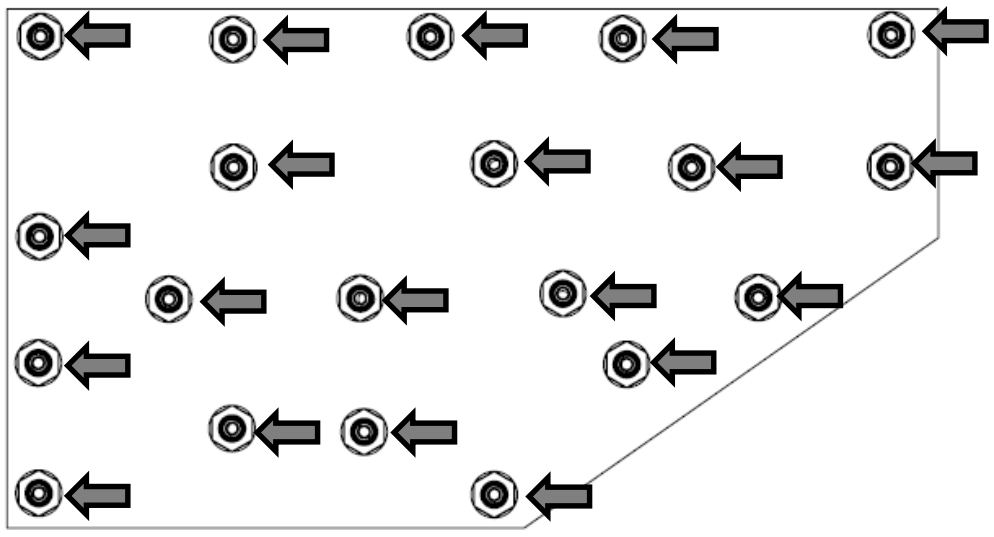
The RB-EX is designed also to be used also with conventional single sided fasteners to ensure that the clamp force is maintained during manufacturing. The issue that can happen with conventional fasteners that are designed to be a dowel fit, is that of the same effect as a conventional dowel, as explained on pages 3-5.



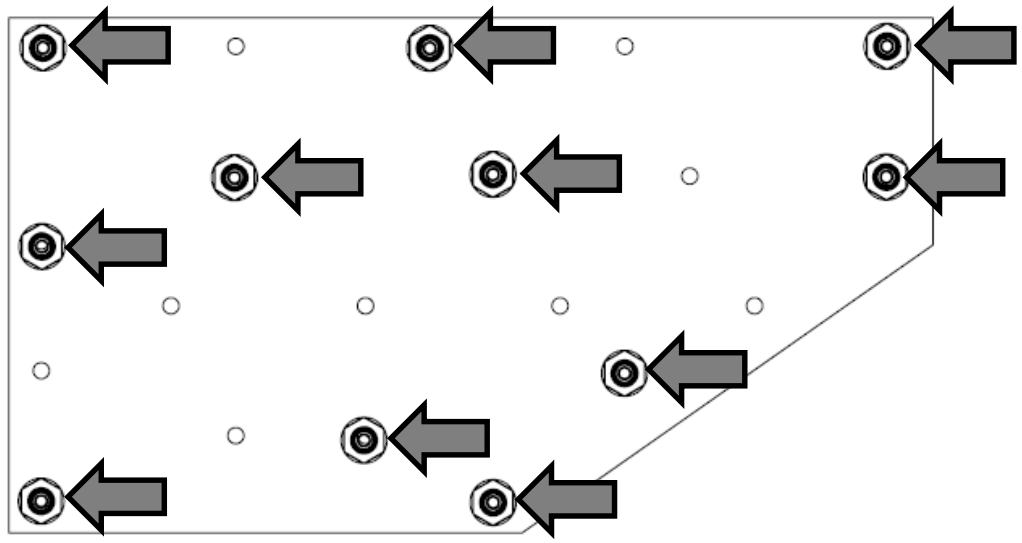
When the clamp force is removed before the shear load, which is then entirely reacted by the collet as the collet is removed this can trap the feet of the collet making removal very difficult, and can cause damage to both the fastener and the structure. This is more evident in large components on the removal of the single sided fasteners when there are only a few fasteners remaining in the structure and especially in areas where there are several components held in place.

FUNCTIONALITY OF THE RB-EX

In this example panel the shear load is shared between all fasteners.



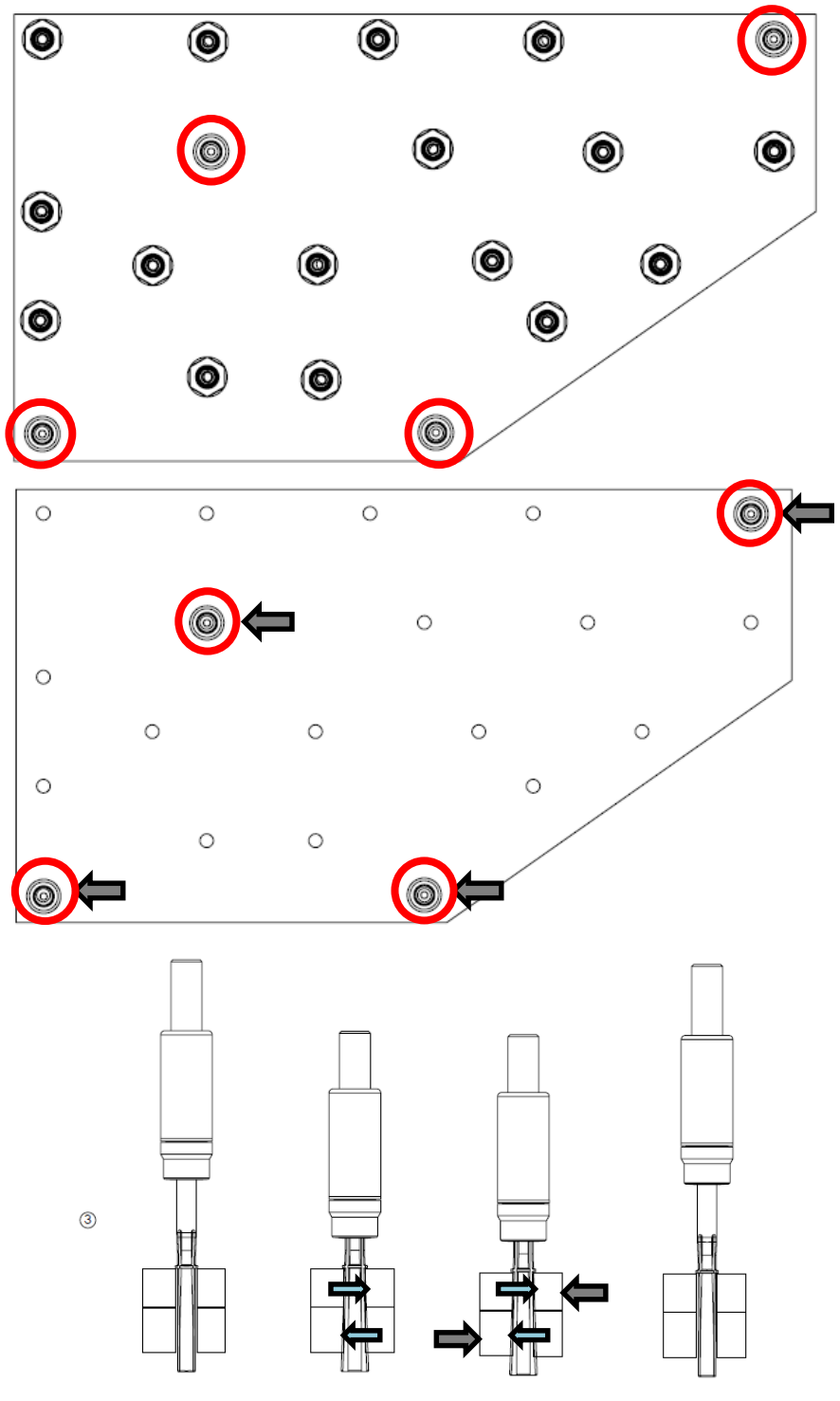
As fasteners are removed the resultant shear load increases making the remaining much more difficult to remove as showing in case 2.



The diagram opposite shows a conventional structure that has been progressively drilled and clamped using the Centrix single sided temporary fastener.

As fasteners are removed, fewer fasteners are left in the structure. If there is misalignment and therefore shear stress, the few remaining fasteners are subjected to this force. In the removal of these last few fasteners the shear force can become a problem in removal of the fasteners due to the frictional forces exerted.

FUNCTIONALITY OF THE RB-EX



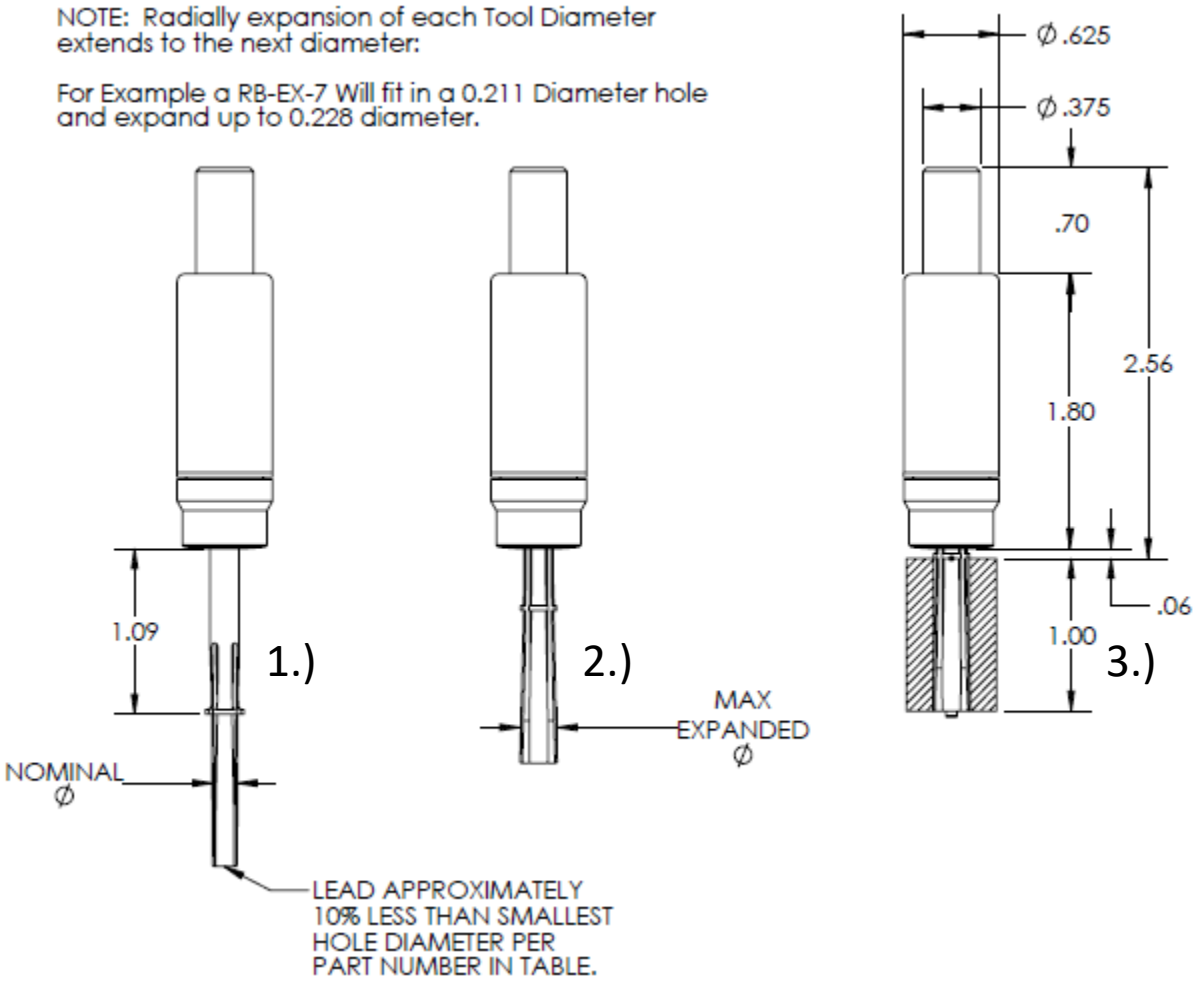
As shown on the previous page, the structure is undergoing shear forces but is held with friction from the clamp force exerted by the single sided temporary fasteners. However, in this case the RB-EX fasteners have also been fitted and are the last four fasteners to be removed (highlighted in red).

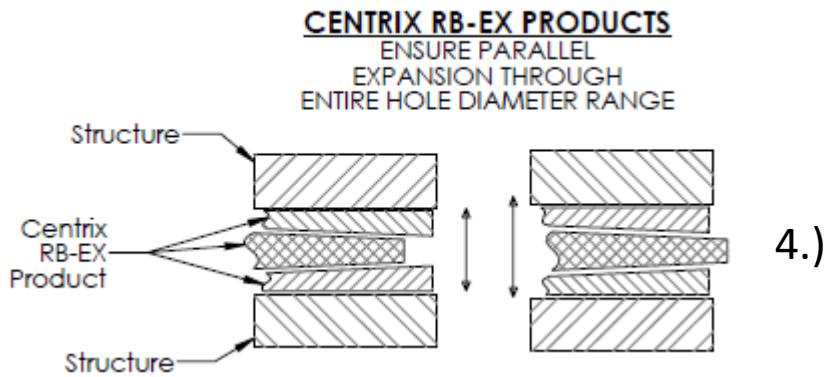
As the standard single sided fasteners are removed one by one, the RB-EX's will react the shear allowing the standard fastener to be removed without misalignment occurring and damage to the aircraft structure.

Note – the RB-EX does not exert clamp force. It is therefore necessary to have a nearby single side temporary fastener applied to keep the panel shear plane together for the RB-EX.

The RB-EX can then finally be removed, and the key difference is that the RB-EX once fully unwound is made to be smaller than the lowest possible drill tolerance for the hole it is designed for.

FUNCTIONALITY OF THE RB-EX





4.)

1.) The RB-EX works by being smaller than the hole that has been produced. Once the hole has been drilled and cleaned out of swarf, the RB-EX is installed into the hole. With torque application, the RB-EX begins to pull the screw into the body.

2.) With the screw winding on the collet drawing it into the body, the legs begin to expand due to a reverse taper existing inside the collet legs. The more the fastener is wound in, the more the taper begins to pull in and expand the legs further.

3.) Figure 3 shows how the RB-EX will look once it is fastened to the required torque for the application it has been manufactured for.

4.) Cut through of an RB-EX showing how it maintains alignment of the product when the expanding dowel is fastened to the requirement of the hole diameter and material.