

# Device for Fixing Turbine Vanes During Brazing

Vanes in gas turbines are components used to direct airflow and optimize turbine performance. They are curved, blade-like structures located in the stator section of the turbine that direct the flow path of the hot gas to improve energy transfer to the rotor blades. Vanes can have various shapes and sizes, depending on the specific requirements of the turbine design and operating conditions. Their primary function is to control the pressure and velocity of the gas flow to enable efficient energy conversion. Modern gas turbines utilize advanced vane designs and fluid dynamic optimizations to maximize performance, efficiency, and reliability. In this context, bushings are small parts with a cylindrical cross section that are used for instrumented turbine parts as guides for tip timing and/or other types of probes. Typically, a hole is brazed into the part and then a bushing is inserted.

During brazing of the bushing, the turbine parts are heat treated. In the current process, turbine parts are exposed to high temperatures up to 1200°C for more than 24 hours. This requires additional considerations for proper fixation and positioning, especially for larger parts such as turbine vane 4. If the vane is incorrectly positioned during heat treatment, the effect of its own weight is not negligible and can cause irreversible deformation. Therefore, the vane cannot simply be placed on a surface and subjected to the treatment in any arbitrary position. At present, turbine blade 4 is supported by a single stilt. In this way, the effect of its own weight is eliminated. However, some rotations of the part are possible, causing a redistribution of the load. On the other hand, during the assembly process of such blades, it is observed that some gaps and steps are present on the platform. Platform steps of 1-2 mm are observed. Although these steps may be related to some other steps in the vane manufacturing process, it is important to provide clear and secure vane fixation to eliminate any possible cause of irreversible deformation.

To date, no specific solution is known from available sources. It is known that casting manufacturers also pay attention to blade positioning during heat treatment to avoid self-weight load redistribution and the effect on blade deformation.

The new approach presented here consists of a fixing structure that can be applied to a wider variety of turbine vanes, ensuring that the self-weight load is distributed to more support points. In this way, unwanted rotations are eliminated and thus no irreversible deformation is expected. The proposed attachment is adjustable to different vane sizes. Basically, it consists of

1. a base plate with a block for ID (Inside Diameter) support,
2. four vertical bolts, screwed into the base plate, whose height can be adjusted by means of a thread, and
3. two separately movable horizontal plates to support the OD (Outside Diameter). One of them is equipped with an additional wedge for better fixation.

Figures 1 and 2 illustrate this design. Figure 3 shows how the device can be used for different blade sizes. Figure 4 gives additional details on possible adjustments to the support device.

This new fixture offers a number of benefits. It prevents unwanted rotation and load redistribution. The movement of the vane during treatment can be controlled and no residual stresses are created. This results in reduced dimensional variation and easier assembly. The new device can be used for vanes of different types and sizes, such as single, double and triple vanes. In addition, more than one vane can be added to the fixture during heat treatment. Finally, the application is not limited to the single process, but can be used in different manufacturing steps if necessary, such as casting process in case of large deflections during heat treatment.

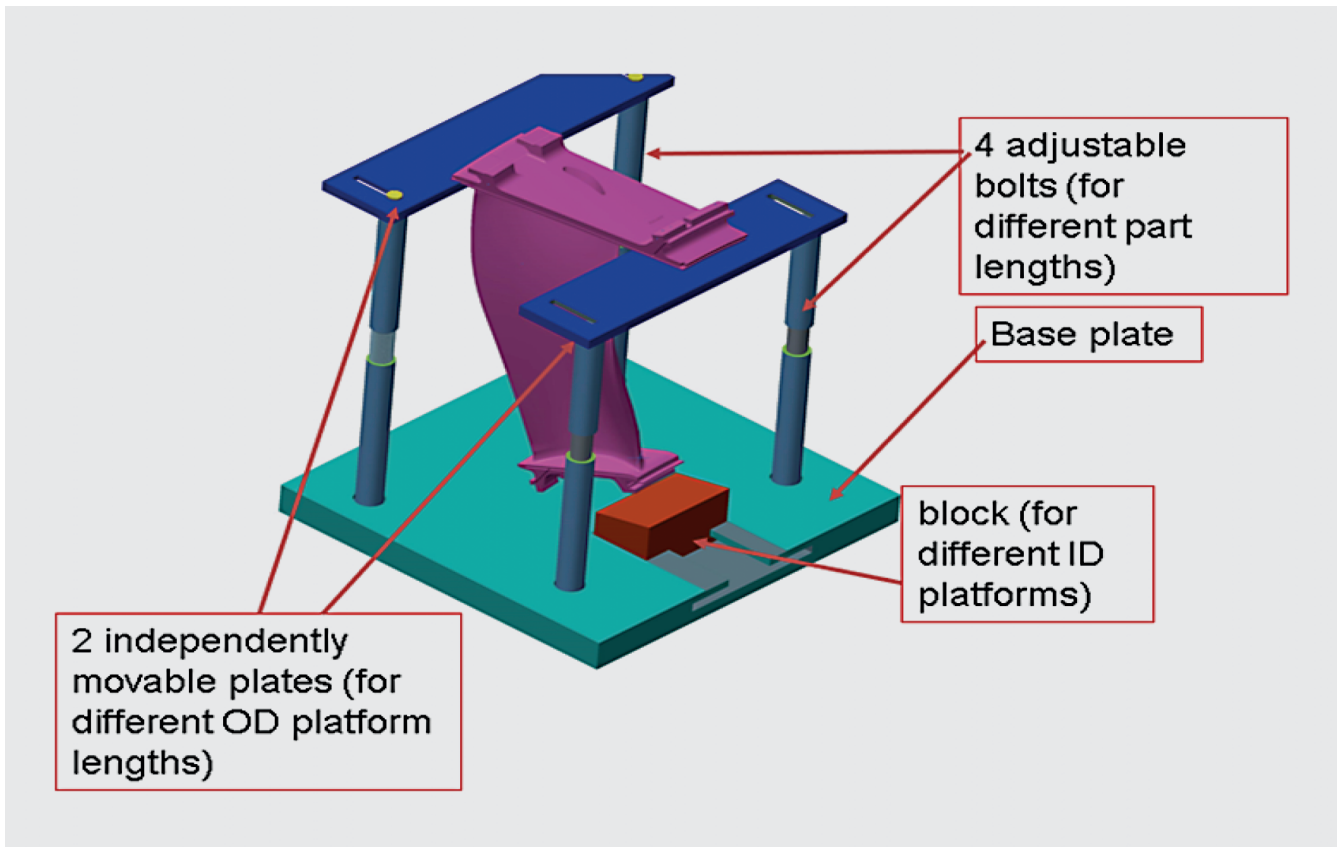


Figure 1: Suggested fixture for mounting different vane sizes

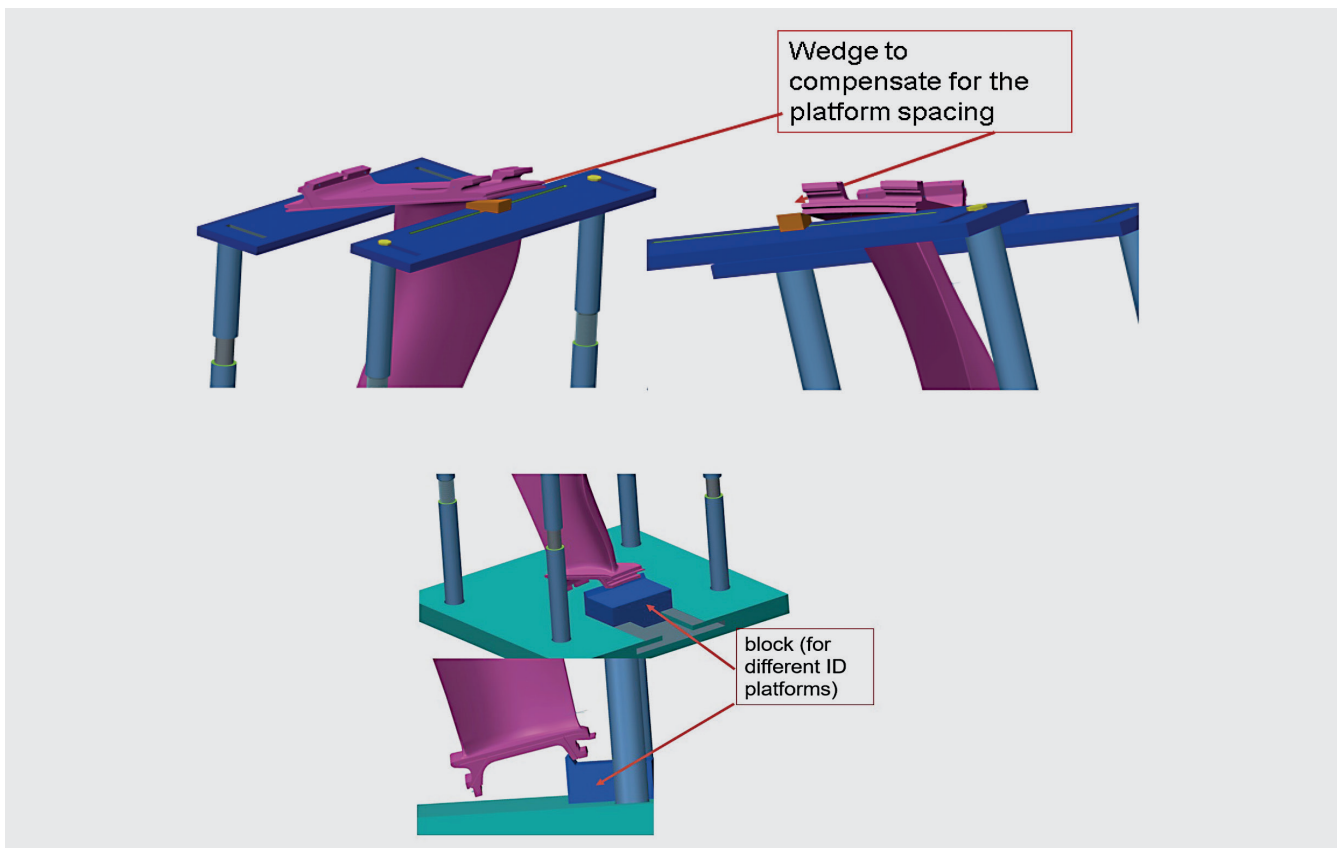


Figure 2: Detailed view of the horizontal plate with a wedge and base plate with block for ID support

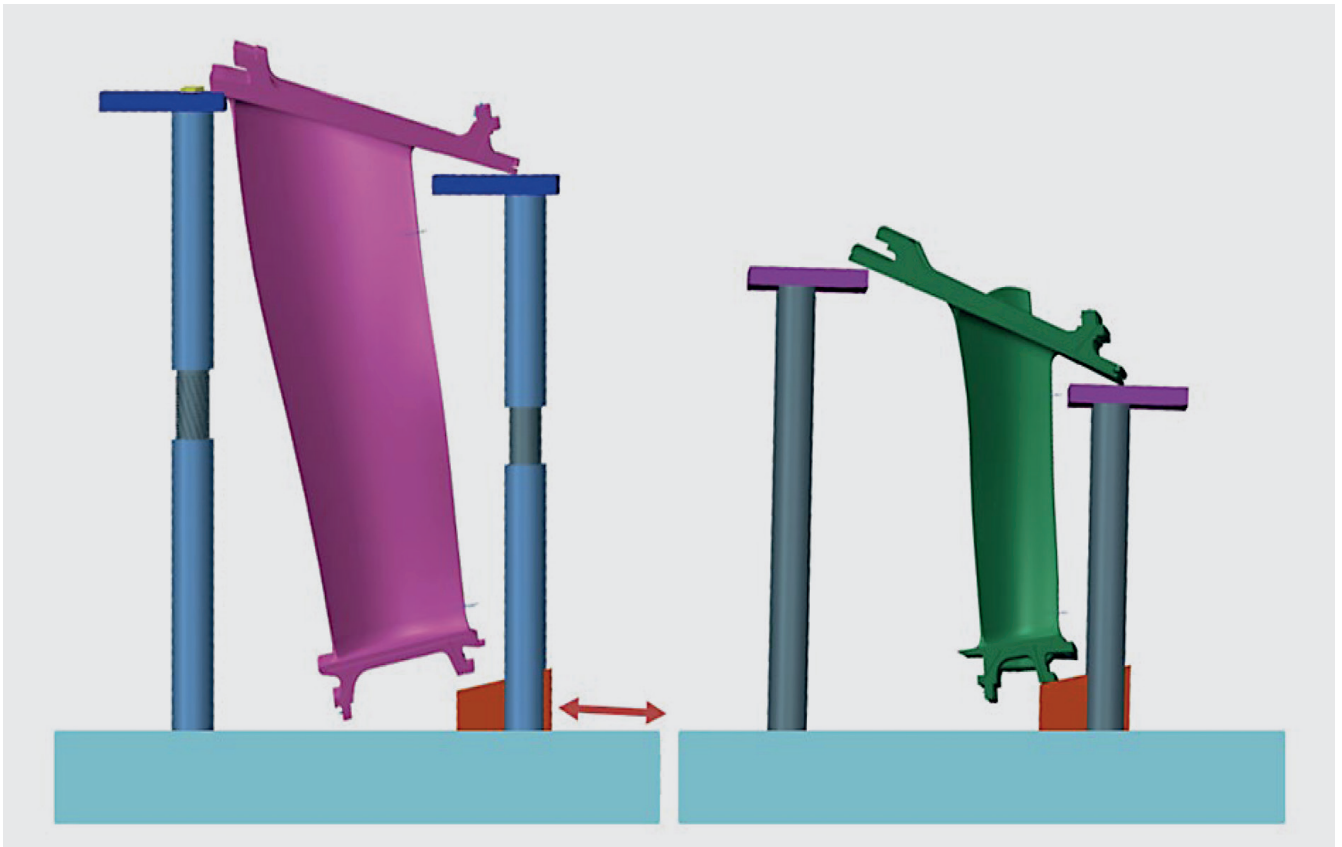


Figure 3: Application of the adjustable device for different vane dimensions

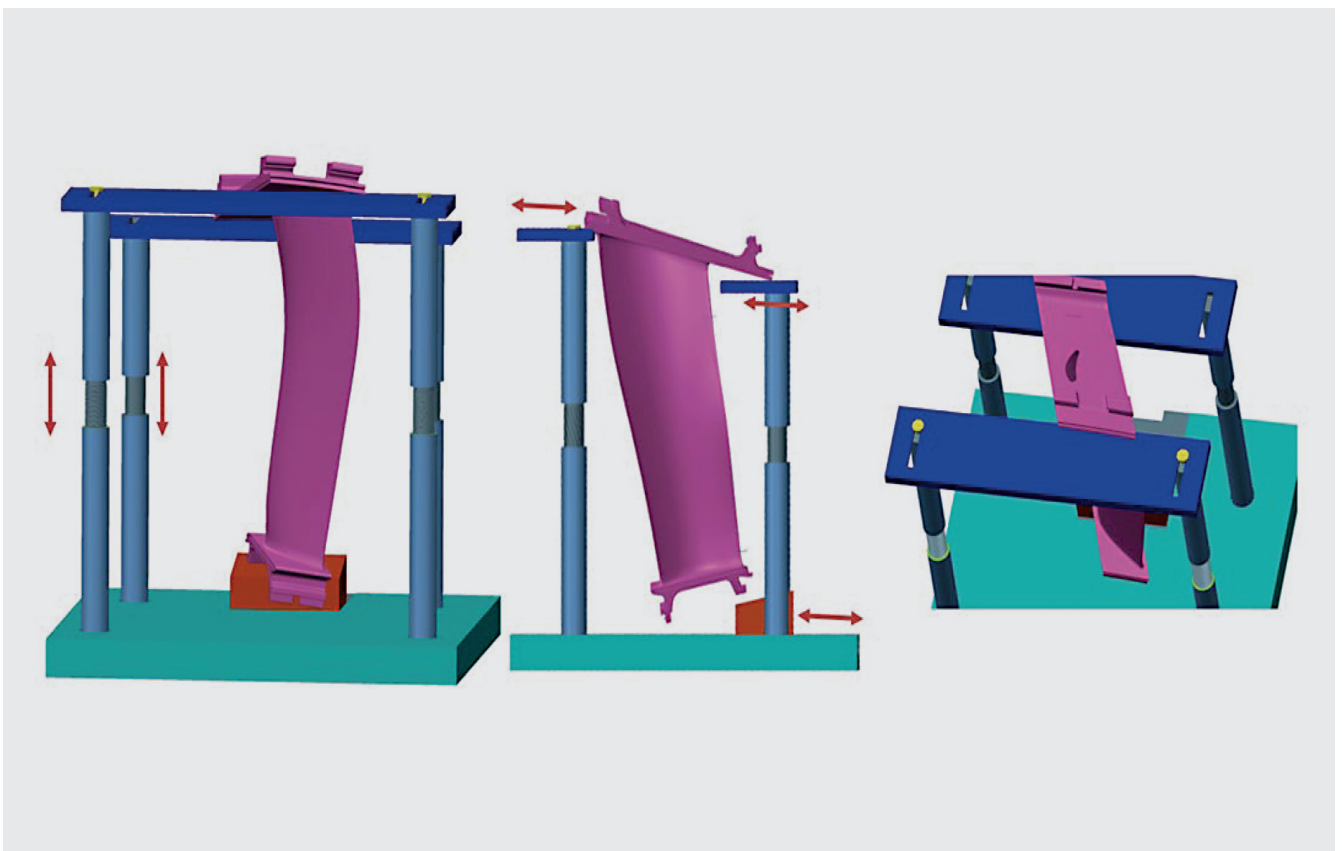


Figure 4: Overview of the proposed device