Flow Turbine Tubes – Laser welding case study

A turbine consisting of 3 stainless steel tubes placed in parallel is made by welding between the end walls of each tube.

In this case the tubes are lightly tack-welded by laser to keep them in the correct configuration relative to each other. This application shows the flexibility of laser welding, where using TIG welding would be too heavy-handed, and vacuum brazing would not be applicable.

Laser welding of similar alloys containing nickel tends to lead to good strong welds, whilst welding dissimilar alloys requires investigation and the possible use of fillers to ensure good welds. Similarly, titanium, stainless steel and other materials can be subject to good strong laser welds.

Like electron beam welding (EBW), laser welding has high power density, of the order of 1 megawatt/cm² (MW), resulting in small heat-affected zones and high heating and cooling rates. The spot size of the laser can be varied between 0.2 mm and 2.0 mm. The depth of penetration is proportional to the amount of power supplied, but is also dependent on the location of the focal point: penetration is maximized when the focal point is slightly below the surface of the workpiece.

A continuous or pulsed laser beam may be used depending upon the application. Milliseconds long pulses are used to weld thin materials such as razor blades whilst continuous laser systems are employed for deep welds, which can take on a keyhole shape, down into the joint between the metals.