



Typical condition of a vane received



Blade with the coupon welded in place



Laser tip repairs



Blade with thin wall section – normal procedure would be to scrap the blade



Leading edge repairs



Picture frame being welded to a transition piece



Laser build-up of a rotor seal

Laser Technologies Developed by Sulzer Elbar

Sulzer Elbar has been pushing the boundaries of blade and vane repairs for many years, permitting parts, that would have been scrapped in the past, to be safely used for extended plant runs.

This has been a big saving for the owners and operators of these gas turbines. In the early days the extension of repair boundaries was achieved using manual welding techniques. Today, the boundaries are being extended using advanced laser welding processes. These advanced processes allow materials with higher mechanical properties to be welded free of defects, and these processes additionally produce less distortion of the work piece.

The laser welding process has been successfully applied to the repair of steam turbine buckets and to the manufacture of new transition pieces. This demonstrates that it is a highly flexible tool that can provide many economic benefits to owners and operators of gas and steam turbines.

For many years it has been commonplace to weld up the squealer tips on rotating blades. However, more exten-

sive welding on blades was limited because the component stresses were greater than the allowable stresses of the weld. Sulzer Elbar has been able to completely replace leading edges on rotating blades using a technique that was originally developed for vanes.

First, the leading edge of the blade is machined away and a matching coupon is manufactured. The coupon is then welded using an autogeneous welding technique (a process that uses no filler) on to the blade. The blade can then be machined to nominal dimensions and the refurbishment process completed as normal.

For many years it has been commonplace to repair vanes using section replacements. However, until recently this has not been possible for vanes manufactured from IN939 – an alloy that can be very difficult to weld without causing further damage. Using specially cast and machined sections from matching materials it is now possible to successfully repair these parts. Sometimes the sections can cover 60% of the airfoil section!

As is the case with the blades, once the replacement sections on vanes have been welded in place and x-rays

have been taken to show that any defects are within the allowable tolerances, the vanes can then be scheduled for the “normal” refurbishment process.

One of the most important processes in the manufacture of transition pieces is the welding. In order to minimize the deformation caused during welding of the picture frame to the body, the process designer decided to use the laser welding process. Laser welding has proven to be very successful and has reduced both the manufacturing time and re-work. It also highlights Sulzer Elbar's view of the world – to consider new innovative processes in the production route where they provide benefits.

The laser can also be used to build up very fine deposits on a rotor without causing any degradation to the rotor itself. The laser process has very limited heat input and therefore only has minor impacts on the base material. Once the laser has built up sufficient material it can be machined to the correct dimensions and the rotor returned to service.

*Fernando Alvarez
Sulzer Elbar*