

Z-Notch & Seal Welding on Shrouded Turbine Blades

APPLICATION Precision application of hardface material to the Z-notch interlock

Knife edge seal and mate face repair

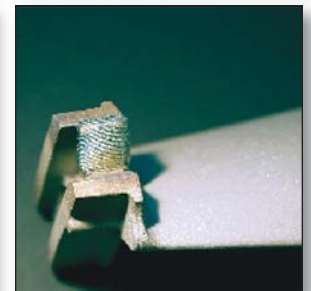
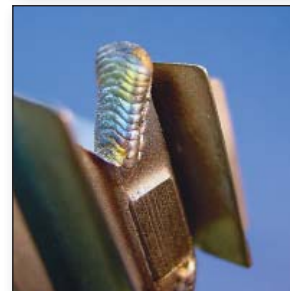
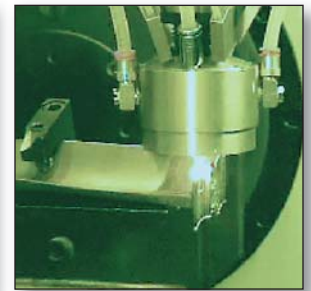
PROCESS For new blades (hard face only), or for repairs parts (Full Z form + optional seals)

Laser powder fusion welding with integrated vision system

Multi-axis machine combines operations thereby completing a full part in one cycle.

Vision system locates critical part features, adjusts for variations, and automatically generates the CNC program.

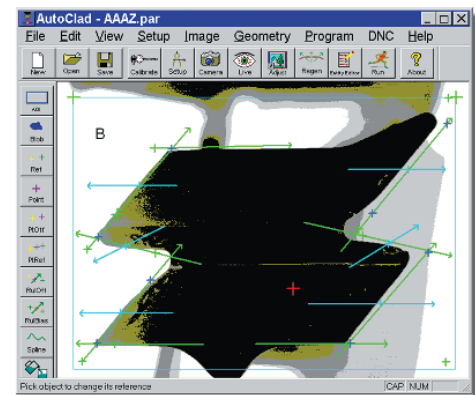
Precise deposition of material minimizes post-weld processing



MATERIAL Hardface material such as Stellite, Coastmetal 64, or T800 and more

CYCLE TIME Depends on blade configuration and material added

Typically under 2 minutes



BENEFITS Laser powder fusion welding on a Huffman Five-Axis Laser Machining System

The vision system is fully integrated into the CNC to minimize operator-induced process variation and produce a significantly more consistent result.

Simple setup and changeover to different parts

High production rate, near net shaped welds

Mate faces and knife edge seal can be welded in the same machine cycle.

Programmable powder feeders enable multiple powders to be deposited in a single machine cycle.



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FEATURE
COMPARISON

	LASER POWDER FUSION WELDING	MIG/TIG/MICROPLASMA WELDING WITH WIRE	COMMENTS
HEAT INPUT	Less heat input means less HAZ, less distortion, less loss of mechanical properties	More heat input means more HAZ and associated issues. More heat is required to melt wire.	Particularly important for heat-sensitive alloys.
FILLER MATERIAL	Powdered Metal. Superalloy powders are less expensive and more readily available than wire.	Wire. Approved as filler in many OEM repair specs, on older parts.	Very difficult to draw wire from brittle superalloys.
CAPTURE RATE	40% - 70%, depending on the application	Up to 100%, less unused wire. (See "weld bead size" below.)	Despite lower capture rates, laser powder fusion welding typically has <i>lower filler material cost per part</i> .
WELD BEAD SIZE	Typically, a smaller weld bead.	A larger weld bead. Relatively large weld puddle required to melt wire. Triple the cost: (1) more expensive material, (2) remove more of it in post-weld operations (3) time and expense of removal operations.	A smaller weld bead creates a part nearer to net shape and causes less downstream processing time and cost.
FILLER DELIVERY SYSTEM	A powder feeder with omni-directional nozzle. This type of nozzle reduces cycle time.	A "follow the wire" wire feeder. This type of feeder is sensitive and requires the wire to be consistent. The wire may "pig tail".	Twin canister powder feeders enable different filler materials to be applied in a single machine cycle.
DEPOSITION RATE	Laser and powder is much faster than microplasma.	Some manual welding operations can be faster, such as for non-repetitive applications, but with high heat input and HAZ.	Must balance deposition rate with <i>total quality and total cost</i> .

