Developments and Opportunities in Laser Cutting (with Case Studies)

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Laser Cutting

Process started in 1980's

Replacement for NC nibbling

Initial Lasers Power 500- 1000W/ Co2

Phenomenal growth in last 35 years (1985-2020)

Laser Sources Used for Cutting



		Nd-Yag (Flash			Direct
	Co2	Lamp)	Fiber	Disk	Diode
					0.940-
Wavelength(µm)	10.6	1.06	1.03-1.10	1.03	0.970
Wall Plug Efficiency					
(%)	7 to15	3 to 4	25 to 40	20-30	35 to 50
Beam Delivery	Mirrors	Fiber	Fiber	Fiber	Fiber
Safety Requirements	Low	High	High	High	High
Maintenance cost	High	High	Low	Low	Low
Maintenance Skill					
Level	Low	Medium	High	High	High
				Average/Goo	
Surface Finish	Good	Average	Average	d	Good
Suseptable to dust	Low	High	High	High	High

Increase in Laser Power





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Maximum Thickness Cut by Laser Cutting











Production Speed



Inherent Advantages of Laser Cutting

No Tooling

Better Material Utilisation

Good Cutting Tolerances

Flexibility on Shapes



Increase in Thickness and Speed of Laser Cutting is Driving Change of Processes thus new opportunities

Turret Punching to Laser Cutting Plasma Cutting to Laser Cutting Waterjet Cutting to Laser Cutting Blanking to Laser Cutting



Change of Process From Waterjet to Laser Cutting, Material: SS304/20mm Size: 600mm X 600mm Industry: Process Equipment

WATERJET CUTTING



LASER CUTTING (4KW)

Cycle Time: 14 min

Time Saving: 70%

Cost Saving: 30%

Challenges: N2 Gas, Material Quality

Change of Process From Blanking to Laser Cutting, Material: Mild Steel/ 2.0mm Size: 520mm X 317mm Quantity: 15000





Change of Process From Blanking to Laser Cutting, Material: Mild Steel/ 2.0mm Size: 520mm X 317mm Quantity: 15000



BLANKING

Press Tool Cost: 9 L

Lead Time: 10-14 Weeks

Raw Material/ Piece:2.88 kgs

Blanking Cost: 12 Rs/Part

Post Processing: Deburring

LASER CUTTING (4KW)

Delivery: 3 weeks

Laser Cutting Cost: 70 Rs/Part

Raw material/Piece: 2.30 kgs

RM Saving: 20%

Challenges: Material Handling, High Tolerances, Productivity compared to Press Tool









Opportunity for Laser Cutting in Automotive Blanking

BLANKING

Productivity: 40-50 Strokes/min

Tool lead time: 14-18 weeks

Tooling Cost

Tool storage and Maintenance

Heavy Foundation

LASER CUTTING

Cutting Speeds: 2m/Sec

Can add Multiple heads

Material Saving

Less Inventory

Flexible Schedules, no setup time

Clean edges for further processing like laser welding

Finally, Material Savings and Volumes will decide the Process



Challenges

Sheet Loading and Unloading

Material Quality/ Straightness/Rust

Nitrogen Supply

Product Designers

Dusty Environment (specially For High power lasers)

Purchase Dept, (Should look at complete cost from tooling, Material Saving, Inventory, etc not just the process)

Machine Construction



Solutions: Material Handling

Loading, Unloading & Sorting Systems for Batch Production

Coil Handling for Mass Production

Mixing the Jobs







Solutions: N2 Supply

Bulk Liquid Nitrogen Tanks

Nitrogen Generators

Explore Air Cutting







Solutions: Material Quality/ Straightness/Rust

Active Speed Control based on the Surface conditions and cut quality

Automatic Edge sensing

Smart Collision Preventive Systems

Advanced height sensing systems



IT'S NOT THE MACHINES BUT MEN AND PROCESSES BEHIND THE MACHINE THAT MATTER







Ideas for Improving Productivity and reducing cost



Areas for Productivity Improvement

Order Entry and Pre Processing Material Saving Software /Nesting/ Programming Scheduling, Cutting Process Gas Consumption Laser Efficiency , Laser On / Beam On

Handling Variety of Drawings -Case Study



Customer: Agro Machinery Manufacturer Manufactures 20+ different machines Components in each machine 80-120 Material Thickness: 0.5 mm to 20mm MS/SS Delivery: JIT, Every day combination 4 to 5 machines Total Drawings Handled in one day 500-600 Material: 8-10 types

Total number of components: 1000+



Handling Variety of Drawings

Use of Simple IT systems

- Mix the orders for better material utilisation
- Labeling/Marking

Pallet systems



Comparison

BEFORE

AFTER

Order Entry time: 3-4 hours

Nesting & Programming Time: 4 hours

Sorting & Labelling: 3 hours

Manpower: 4

Material Utilisation: 75%

Order Entry time: 3 min

Nesting & Programming Time: 1 hour

Sorting & Labelling: 2 hours

Manpower: 2

Material Utilisation: 79%

Reducing Gas Consumption



Nitrogen Cutting and High speed Cutting

Gas Consumption Depends on Nozzle Dia and Gas Pressure

Try using smaller Nozzle dia with better beam alignment

1.7 mm dia @ 16 bar – 26 Nm3/hr

1.4 mm dia @ 16 bar – 17 Nm3/hr

35% saving



Material Saving + Reduction in Cycle time

Customer: Automotive

Part:

Material :16mm HR

Sheet Size: 4000 X 1500

Improvement: Slight Change in the Design without affecting the Performance to accommodate common line cut







Results

BEFORE

of parts/Sheet: 96

RM Required for each part: 7.85 kgs

Length of cut / Part: 1.99 m

AFTER

of Parts/Sheet : 110 (15% More)

RM required for each part: 6.85 (13% less)

Length of Cut/Part: 1.43 (35% Less)



Accurate Costing / Quoting for Laser cutting

Understanding the requirement Length of Cut and No of Piercing Complexity factor Tolerance required Loading and unloading time Part variety Urgency Labeling/Marking and packing requirement Machine Hour / Value addition



Conclusion

Lasers Power is continuously increasing Due to which Thickness and Speed is increasing Relook at the present process for opportunities Supporting Equipment/ Systems can become bottle necks Designing for Laser Cutting will drive new applications Processes and Systems Pre and Post laser cutting are as Critical



Magod Laser Machining Pvt Ltd

"To make available the latest Manufacturing Processes and Solutions to Indian Industry"

Established: 1997

Head Office: Bengaluru

Employees: 300+

25+ laser processing equipment with combined wattage of 88,000

Facilities: Bengaluru (Jigani, Peenya, Dabaspet)

Chennai (Ambattur, Sriperumpudur), Dharwad, Pune (Magod Fusion)





Services Offered

Laser Cutting (2D/5Axis/Tube/Fine)

Laser Welding (Micro/Macro/Plastics)

Laser Cladding

Laser Hardening

Laser Drilling

Additive Manufacturing – 3D Printing Metals

Research & Development (Laser Based)

Fabrication



Thank you

Question & Answers