

**CO₂-Powered
Manufacturing**

Higher Quality Products. Better Profitability. Minimal Environmental Impact.

Manufacturing processes are often complex and very costly. For companies to remain competitive in the evolving industrial landscape there is a need to revisit their processes and acquire new technologies that are simple, robust and economical.

Carbon Dioxide (CO₂) as a waste by-product of many industrial processes is abundant and safe. It forms a valuable resource for high-tech or high-reliability product manufacturing applications, performing basic functions like precision cleaning, extraction, disinfection, cooling and lubrication, and also can be used in synergistic processes with atmospheric plasma, laser, etc.

Why CleanLogix?

With over 30 years of industry experience working with hundreds of leading manufacturers - both large and small - our advanced CO₂-technology has enabled these companies to implement lean processes, reduce waste generation and improve profitability. We provide a variety of unique CO₂-enabled manufacturing solutions which:



Increase Yield in the form of reduced part rejects, improved cleanliness, lower process variability, better surface finish, or improved product performance ...



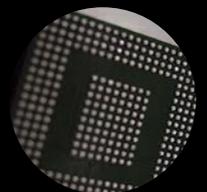
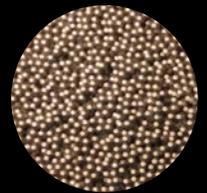
Increase Productivity in the form reduced manpower, faster cutting, reduced cleaning process steps, longer tool life, or adaptability to conventional assembly tools and automation processes ...



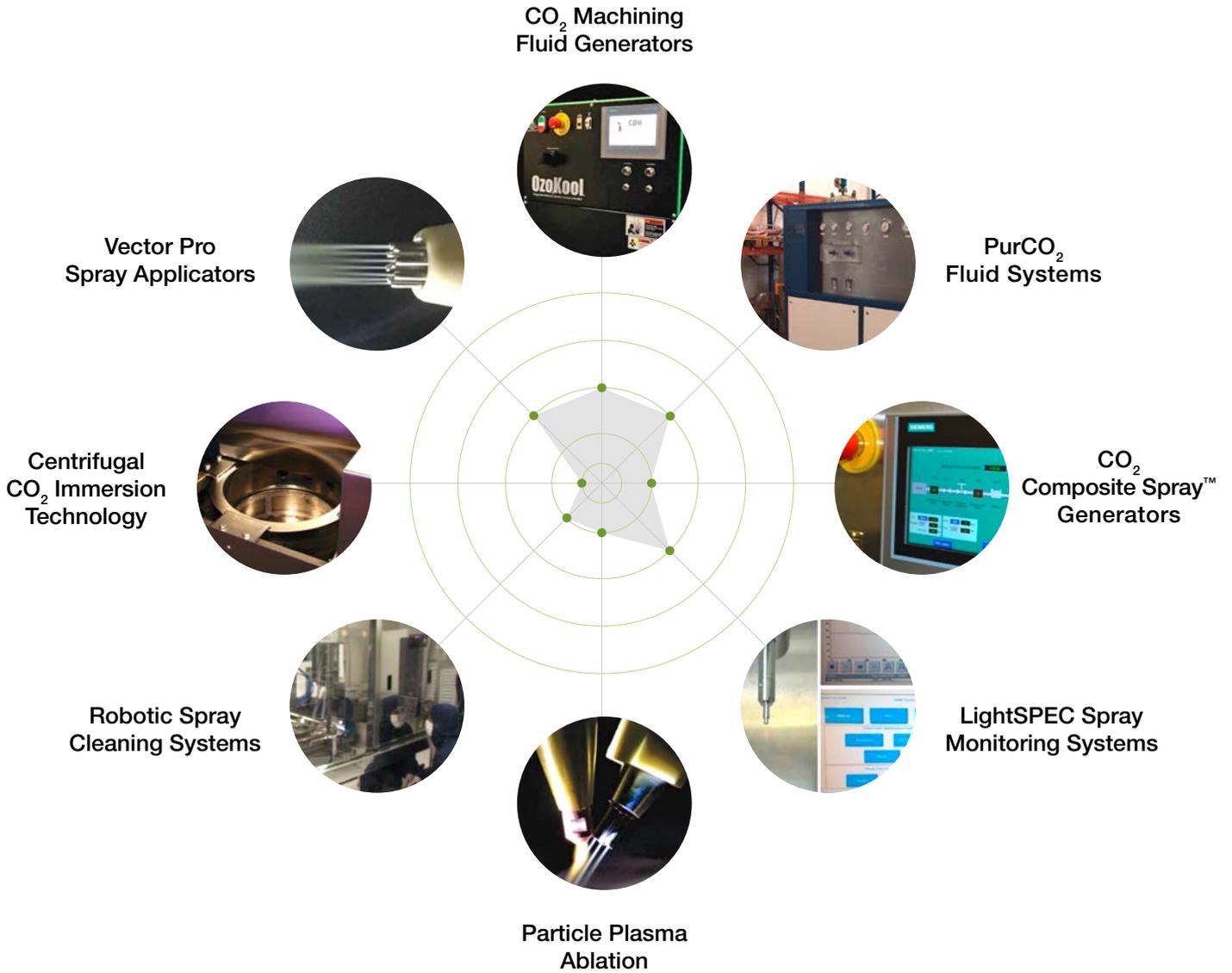
Lower Manufacturing Waste in the form of reduced energy, no water usage, less space, lower labor inputs ...



Increase Environmental Quality through the elimination of solvents and waste cleaning by-products, less air pollution, and the elimination of permitting tasks and pollution management facilities ...



Versatile CO₂ Manufacturing Solutions



Precision Cleaning

- Particles
- NVR
- Ionics
- Organics



Hard Machining

- Titanium
- Inconel
- Superalloys

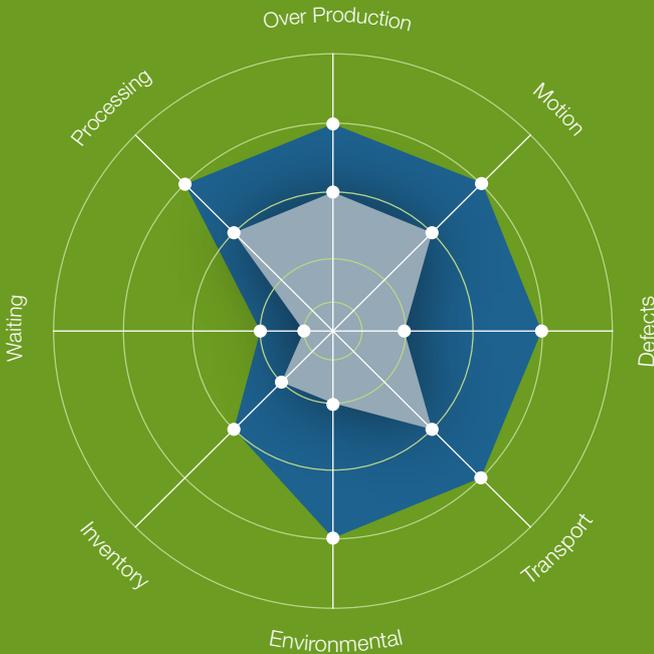


Surface Cooling

- Injection Molds
- Thermal Spray Coating

High Performance – High Volume

Cleaning Cost Reduction



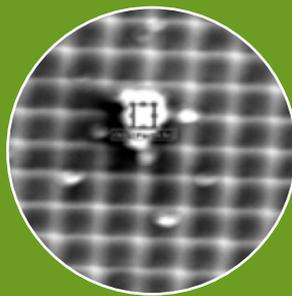
Ultrasonic Aqueous Cleaning		Robotic CO ₂ Cleaning
DIW/Ultrasonics Hot GN ₂ Drying Non-Selective	Process	CO ₂ Spray Dry-In/Dry-Out Selective
160 ft ²	Space	45 ft ²
2500 PPH	Capacity	2500 PPH
\$0.12 - \$0.13 per part	CpC	\$0.02 - \$0.06 per part

CMOS Image Sensor

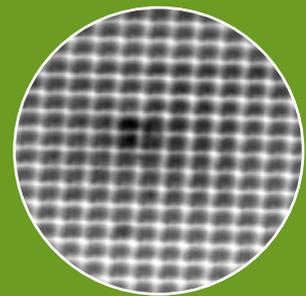
During CMOS image sensor manufacturing processes such as cutting, adhesive bonding, wire bonding, plasma treatment, alignment, transport and handling – the surfaces of the CMOS image sensor become contaminated with a wide range of contaminations. These must be removed from the active (pixel) area of the sensor to prevent

obscuration and distortion of light to provide crystal clear image and video capture.

CO₂ Composite Spray™ cleaning is a proven and superior, non-contact method for damage-free, dry cleaning of CMOS image sensors.



Before



After CO₂ Composite Spray™

CMOS Active Sensor
Benchtop SEM

Cleaning and Activation

Cleaning prior to Painting

Conventional aqueous cleaning methods incur significant resources i.e. time, energy, footprint, consumables etc. These translate into increased manufacturing costs.

CO₂ Composite Spray™ provides better yield at a fraction of the costs.



Before



(a) After Power washer



(b) After CO₂ Cleaning

Surface Activation of Polymers

Clean, wettable, and reactive surfaces are a basic requirement for consistently and effectively joining or coating low surface energy polymers and composites.

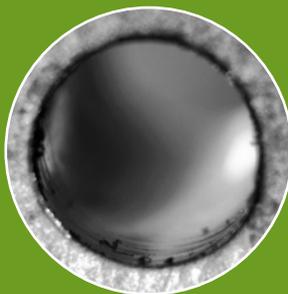
Particle-Plasma Ablation™ (“PPA”) technology insures hard-to-bond polymers with a clean and proper micromechanical and chemical bonding foundation for the application and cure of coatings such as glues, paints, sealants, and underfills.



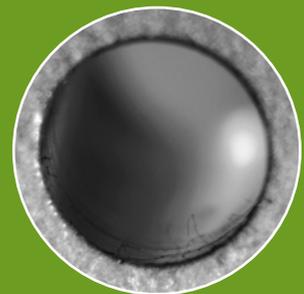
CO₂ Performance in Machining

The aerospace industry today is posed with numerous challenges with the introduction of new materials and components – one of which is the requirement to drill of

difficult materials (i.e. titanium, composites, acrylics etc.) absent conventional lubricants.



Before Air Only
Room Temperature



After Micronized CO₂-in-Air
Refrigerated – No Lubrication

CleanLogix's ‘CO₂ cooling-lubrication with Tunable MQCL’ has presented compelling results to address this issue.

About Hitachi High-Technologies

Hitachi High-Tech Group has developed a global business around the four segments of science and medical systems, electronic device systems, industrial systems and advanced industrial products with the corporate vision of “to consistently aim to be global top in high-tech solutions” and the mission of “to turn our customers into fast-moving, cutting-edge businesses.”

Toward that end, we will embrace the “challenge to change”, by which we will meet individualised customer needs with meticulous care and work on a “transform to more customer-centric organisation” in which we provide solutions with a high level of expertise and “transform to an autonomous and decentralised organisation” where employees think, decide and act independently with the perspective of total optimisation.

About CleanLogix

CleanLogix, pioneer of CO₂ Composite Spray™ Technology, enables high-efficacy removal of thin-film complex contaminants from a range of substrates. Utilising re-purposed CO₂, it is economical, safe for workers and has minimal environmental impact.

The technology can be implemented in various schemes: Its unique versatility provides manufacturers with many ways to improve the profitability and performance of their production operations.

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