Dissolved Gas Infusion

DGI TECHNOLOGY AT A GLANCE

Efficient Gas Transfer for Water & Wastewater Treatment Processes with DGI

Fuel Tech's DGI® Dissolved Gas Infusion technology offers an efficient, safe, and environmentally friendly solution by using pure oxygen, carbon dioxide or other gases for a variety of water treatment processes.

About DGI

DGI is cutting-edge technology that achieves superior rates of 99+% gas transfer by pre-dissolving high-purity gas in a separate pressurized slipstream.

DGI can work as a rapid response option or augment underperforming legacy technologies in a wide range of water and wastewater treatment processes.

How DGI Technology Works

Pressurize: A slipstream of process water is pressurized to maximize achievable dissolved gas concentration.

Infuse: The pressurized slipstream is introduced into Fuel Tech's patented saturator through a jet nozzle where it quickly is infused with dissolved gas. This results in 95+% saturation efficiency.

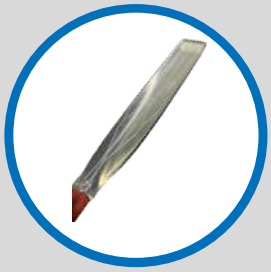
Inject: The gas laden slipstream is returned to the process basin through patent-pending channel injectors for optimal gas dispersion independent of water depth resulting in 99+% injected gas transfer independent of water depth.

Markets Served

- Agriculture/Irrigation
- Aquaculture
- Chemical/Petrochemical
- Food & Beverage
- Landfill Leachate
- Pulp & Paper
- Reservoirs
- Water & Wastewater Treatment

DGI Key Innovations

Patented next-generation saturator



Unique channel injectors minimize in-basin equipment

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DGI OXYGEN

With DGI's best on the market oxygen transfer efficiency, the slipstream can reach up to 900 mg/l oxygen concentration. It is then added to the main volume of water and diluted to meet precise specifications.

DGI was tested using a modified version of the Measurement of Oxygen Transfer in Clean Water standard published by the American Society of Civil Engineers (ASCE/EWRI 2-06).

95%
95% oxygen infusion efficiency

99+%
Up to 99+% DO transfer from the slipstream

Application of Oxygen Series

Fuel Tech's DGI oxygen transfer is particularly beneficial for:

- **Biological Treatment:** Elevating oxygen levels to support aerobic bacteria, optimizing biological processes and enhancing the overall efficiency of wastewater treatment systems
- **Odor Control:** Maintaining proper oxygen levels to mitigate the formation of hydrogen sulfide and other odor-causing compounds, keeping wastewater systems odor-free
- **Primary or Supplemental Aeration/Oxygenation:** Delivering efficient oxygenation for primary water treatment stages or serves as a supplemental oxygen source during high-demand periods

Benefits

Increased Safety: Full compliance with National Electric Code article 682 with minimal in basin maintenance

Cost Effectiveness: Primary or supplemental oxygen without major plant modifications or capital outlay

Environmental Impact: Pure oxygen increases the alpha factor resulting in lower oxygen usage, and reduces malodor formation

Logistics Efficiencies: Simplified maintenance and spare parts requirements

Operational Efficiencies: Provides precise and consistent oxygen control using DO or ORP setpoints independent of water depth

Insurance & Compliance: Reduced risks and simplified compliance can lead to lower insurance premiums & fewer regulatory fines

Oxygen Product Specifications

Model		O-2-6	O-4-25	O-6-60	O-8-100	O-12-240
		Oxygen - Lb/day @ 200 PSI, water at 1 PPT Salinity				
Max. Oxygen Output	Water Temp. 10 °C (50 °F)	45	180	406	721	1,622
System Operating Range	Nominal Fluid Flow, GPM	7	27	61	108	244
	Operating Pressure, PSIG	50 – 300				
	Ambient Temp. °F	40~104				

DGI CARBON DIOXIDE

On-Demand Carbonic Acid Generation

Pre-treatment of wastewater prior to discharge to a local municipality is required of many industries. When those industries utilize chemicals that alter the pH of wastewater, either in production or clean-up operations, they are required to correct the pH prior to discharge. Traditional methods involve the transportation, storage, and handling of strong acids, raising several concerns related to safety, cost, and environmental impact.

Fuel Tech's On-Demand Carbonic Acid Generation process leverages DGI technology to generate carbonic acid from CO_2 on-demand and in situ, offering a safer and greener alternative to traditional strong acids used for pH control.

Application of CO_2 for pH Adjustment

By dissolving CO_2 into water, carbonic acid is formed, which offers a moderate and controllable pH adjustment without the risks associated with strong acids. This is particularly beneficial for:

- **Municipal Water Treatment:** Enhancing pH stability in drinking water systems
- **Wastewater Treatment:** Neutralizing alkaline wastewater before discharge
- **Industrial Processes:** Balancing pH in various manufacturing and processing stages

Benefits

Increased Safety: Eliminates hazardous handling & storage of strong acids

Cost Effectiveness: Reduces chemical procurement & storage

Environmental Impact: Lowers the carbon footprint by reducing the transport of corrosive chemicals

Logistics Efficiencies: Reduces bulk chemical shipping lowering operational costs

Operational Efficiencies: Provides precise and consistent pH control enhancing overall water treatment efficiency

Insurance & Compliance: Reduced risks and simplified compliance can lead to lower insurance premiums & fewer regulatory fines

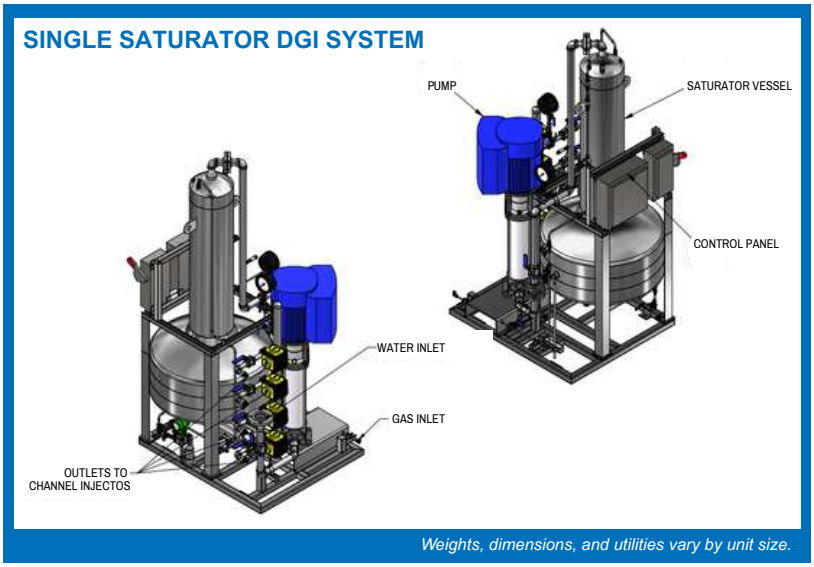
CO_2 Product Specifications

Model		C-2-6	C-4-25	C-6-60	C-8-100	C-12-240
		CO_2 - Lb/day @ 200 PSI, water at 1 PPT Salinity				
Nominal CO_2 Output	Water Temp. 10 °C (50 °F)	1,516	6,062	13,640	24,250	54,560
System Operating Range	Nominal Fluid Flow, GPM	7	27	61	108	244
	Operating Pressure, PSIG	50 – 300				
	Ambient Temp. °F	40~104				

WHY FUEL TECH?

Fuel Tech has a 30+ year track record of innovative, effective technologies that remediate pollution, improve efficiency, and enable cleaner production processes. We are a well-capitalized, customer-centric organization focusing our expertise on improving water treatment to create a unique combination of technologies that outperform existing options:

- Patented saturator operated at up to 300 psi to achieve market-leading gas transfer while minimizing water usage.
- Delivery device inspired by our long history of injector development optimizes formation and dispersion of dissolved gas.
- Zoned injection approach that provides flexible and targeted operation with precise control options.
- Total system backed by experienced process and product engineering teams able to custom-design solutions to fit unique applications.



Weights, dimensions, and utilities vary by unit size.

Pilot Units Available

Fuel Tech has units available for pilot testing, demonstrations, and rentals for oxygen and carbon dioxide applications. The oxygen system pilot units have oxygen capacity ranging from 10 – 10,000 lb per day, and carbon dioxide units from 1,500 - 54,000 lb per day. All units are subject to prior commitments.

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Fuel Tech develops and commercializes state-of-the-art proprietary technologies for air pollution control, process optimization, water treatment, and advanced engineering services. These technologies enable customers to operate in a cost-effective and environmentally sustainable manner.

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