From Concept to Reality
Driving CO$_2$ Solutions
About | Air Water Inc.

- Acquired TOMCO2 Systems February 23, 2018
- Headquartered in Osaka, Japan with ~$6B in Annual Sales (98% in Japan)
- >12,000 Employees
- A Market Leader in Japan Industrial Gas & Cryogenic Equipment
- Focus on International Acquisitions
  - Preference Towards US Manufacturing Companies with Engineered Industrial Gas Products
  - Acquire, Invest, & Grow
About | Expansion – New Partnerships

- Acquired by Air Water in 2016
- Global Leader in Cryogenic Tank Manuf
  - Vacuum-Insulated Bulk Tanks
  - MicroBulk
  - Liquid Cylinder
  - BevCarb
  - LNG
Backdrop | Then & Now

1970

Present Day
Backdrop| Qualifications

- Experience in CO2 and Water Treatment Systems
- Number of Systems Installed – Over 1500
- Active Member of CGA
- Engineering Capability
- Optimized pH Control and CO2 Utilization
- Total System Responsibility
- ASME Pressure Vessel Shop
- Service Capability
- Made in the USA
Advantages of Bulk Storage

- Most Economical Way to Store CO2
- Access Manway & Refrigeration Coils Standards
- Optional Refrigeration Package Available
- Ability to Provide a Refrigerated Tank Eliminates CO2 Losses
- More Energy Efficient For Both Vapor and Liquid Withdrawals
- Aluminum Jacket and Seals to Protect Insulation
- 4” Insulation Standard and Optional 6” Flex Flow Available
Backdrop | Lease To Own Option

- TOMCO Lease/Own Agreement Allows Owners to Change CO2 Suppliers at Will
- CO2 Gas Suppliers Lease Agreement Do Not Allow other CO2 Suppliers to Fill Their Tank
- TOMCO Lease/Own Agreements can Include Freight & Installation
- Benefits from TOMCO’s 24/7 Service and Technical Support
- Has Access to TOMCO’s TurnKey Installation Service
About | What is CO2?

- Carbon Dioxide is a gas at normal atmospheric temperature and pressure. It is a colorless, odorless gas that is about 1.5 times more dense than air. It dissolves in water to form carbonic acid; H2CO3.

- Carbon dioxide gas is formed from the combination of two elements: carbon and oxygen.

- CO2 is produced from the combustion of coal or hydrocarbons, the fermentation of alcohols, the production of anhydrous ammonia, by-product of other chemical processes, occur naturally in deep CO2 wells and the breathing of humans and animals. Found in small proportions in the atmosphere, it is assimilated by plants which in turn produce oxygen.
• Stabilize Water Chemistry
• Corrosion Control
• Discharge Wastewater (Permit)
• To Reduce or Prevent Carbonate Scaling
• To Enhance a Chemical Reaction or Process
  – Polymers, Chlorine, Lime, Filtration, Contaminant Removal
Equipment | pH Control

- CO₂ Storage
- Vaporizer
- Vapor Heater
- Pressure Regulator
- CO₂ / H₂CO₃ Feed Panel
- Diffuser
**Equipment | Bulk Storage**

- **C-Style Series**
  - 3.75 Tons – 60 Tons Capacity

- **V-Style Series**
  - 6 Tons – 100 Tons Capacity

- **E/WTC-Style Series**
  - 3.75 Tons – 120 Tons Capacity
Equipment | Vaporizers

- **Electric Pressure Build**
  - 245 #/hr – 2150 #/hr

- **Waterbath**
  - 500 #/hr – 20,000 #/hr

- **Steam Heated**
  - 500 #/hr – 18,000 #/hr

- **Direct to Process**
  - 375 #/hr – 2,250 #/hr
Equipment | Vapor Heaters

Electric
720 #/hr to 1440 #/hr (Wall)
2000 to 6000 #/hr (Floor)

Steam
500 #/hr to 6,000 #/hr
Equipment | CO2 Feed Systems

**CO2 Gas Feed**
- 60% - 85% efficiency of the carbon dioxide
- Needs deep contact or holding basins.
- Able to reduce the pH to 7.0

**Carbonic Acid (PSF)**
- Minimum 95% efficiency of the carbon dioxide
- Able to reduce the pH to 5.5 – 6.0
- Can be injected in a pipe, basin, tank or shallow channel.
- Eliminates the need for deep contact or holding basins.
**Systems | CO2 Gas Injection**

- Gas (CO\(_2\)) + Liquid (water) reaction takes time
- Requires tremendous surface area (fine bubbles)
- Interference of other gases; i.e. air
- Requires mixer or baffles to hold the gas down in the water
- Lower efficiencies due to gas bubbles at the surface
Systems | Carbonic Acid Injection (PSF)

- CO₂ pre-reacted to form Carbonic Acid
- Liquid / Liquid (Carbonic Acid / Water) Reaction
- Immediate reaction (Requires less time)
- Close to 100% efficiency
- Higher pressure improves CO₂ solubility
- More effective pH control
- Faster reaction time reduces scale potential.
Equipment | Diffusers

Gas Feed
- Uses fine porous diffuser to disperse the CO$_2$ into a deep basin.

Carbonic Acid
- Disperses Carbonic Acid into a water stream to form the chemical reaction desired. Designed to fit in any situation.
Equipment | Carbonic Acid Diffusers (Patent # 6637731 & 6767008)

- Counter Current
- Cross Sectional Coverage
- Pressure
- Efficient Mixing
- Immediate Reaction
• Dewars (Mini Bulk)
  – 400 # Liquid CO₂
• High Pressure Cylinders
  – Multiple Size Gas
• Stack Gas
  – Contains 10 % - 12 % CO₂
• Submerged Combustion Burners
  – Uses natural gas, butane, propane or digester gas to produce CO₂.
Industrial Applications

Power Industry
- pH Control for Ash Ponds
- pH Control for wastewater and Boiler Blow Down water.
- Scale reduction of cooling water

Steel & Chemical Industry
- pH Control for Wastewater, Boiler blow down water.

Textile Industry
- pH Control for Wastewater.

Concrete & Mining Industry
- pH Control for Wastewater.
- pH Control for Storm water Run Off.

Food and Beverage Industry
- Carbonation
- Formation of Hypochlorous Acid For Bacteria Kill
- pH Control for Wastewater.
Industrial pH Control Methods

• Liquid CO$_2$ Feed Systems
• Gas Eductor / Vacuum Feeder
• Chlorinator / Solution Feeder
• Carbonated Water Feeder
• Mineral Acids