CHART CO_2 APPLICATIONS

Carbon Dioxide (CO_2) – CO_2 has much different properties than other inert industrial gas products such as nitrogen and argon. CO_2 is unique in that it is stored under pressure as a liquid in various size Chart tanks, but used as either a liquid, a gas or a solid in a number of different application areas. Liquid CO_2 cannot exist at atmospheric pressure.

- Liquid CO_2 is not considered a cryogenic fluid like nitrogen or argon. At normal storage pressures, liquid CO_2 ranges in temperatures from 0°F to 40°F. It is still most efficiently stored in vacuum insulated storage tanks.
- Unlike cryogenic fluids like nitrogen and argon, CO_2 can be recondensed with readily available commercial refrigerants. This allows Chart to use refrigeration coils in CO_2 bulk tanks and appropriately sized condensing units (if required) in order to store CO_2 in our tanks for an indefinite period of time.
- Liquid CO_2 has the unique property where at pressures below approximately 74 psig, it sublimes (goes directly from liquid to solid). This solid state of CO_2 (dry ice) has numerous industrial applications.
- CO_2 has slight acidic properties that can be used to buffer pH or add carbonation to beverages.
- CO_2 is inert, similar to N_2 and Ar – it is non-reactive with other materials, will not support combustion, and is heavier than air.
- CO_2 enhances growth in plants at concentrations elevated above normal atmospheric concentration.

Chart CO_2 products support a wide variety of applications.

- **Beverage carbonation** — both fountain (Carbo Series tanks) and bottled sodas (Bulk and Perma-Max™ tanks). Transport units (Orca™ trucks) are used to deliver liquid CO_2 to these applications.
- **Draft beer dispensing** — using Carbo Series tanks to supply CO_2 for transferring draft beer from remote keg rooms to bar taps.
- **Breweries** — CO_2 has a number of applications in breweries to include carbonation, kegging, bottling, and purging.

- **Food Freezing/Chilling/Packaging** — flash freezing processed foods using freezing equipment that utilize liquid CO_2 to provide the cold environment for freezing the food. CO_2 is also used for temperature control in large blenders as well as for packaging food for shipment. Most of these production facilities require large, high volume bulk tanks to support these applications.
- **Enriched Atmosphere Grow Houses** — increases growth rate and yield for various types of plants that are grown in enclosed green houses where the atmosphere can be controlled. Since these grow houses can vary in size, a range of tank sizes are used to support this application. From Carbo-Max® 750 lb tanks up to large Perma-Max™ sizes and even some Bulk tanks are used.
- **Carbon Capture** — takes byproduct excess CO_2 from applications (ex: breweries), refines it and stores it for use in other applications needing CO_2 (ex: grow houses). Chart Earthly Labs equipment captures the byproduct CO_2, refines it and stores it in Carbo-Max or Perma-Max tanks.
- **Carbon Cure** — uses CO_2 to enhance the technical performance of materials and accelerates processing, such as ready-mix concrete curing. Injecting CO_2 into ready-mix concrete not only reduces the amount of cement required, but also allows manufacturers to claim carbon credits for tax savings opportunities. Perma-Max tanks are mostly used in this application.
- **pH Control** — used to neutralize pH in moderately alkaline water. This allows improved disinfection rates (such as commercial swimming pools) or treats wastewater prior to discharge in public systems. The volume of water to be treated determines the size of the CO_2 storage tank needed. Large Carbo-Max series tanks, Perma-Max and Bulk tanks are used.
- **Safety & Fire Suppression** — CO_2 is an excellent fire extinguisher, especially on electrical or electronic fires. Chart liquid CO_2 medium sized Perma-Max and Bulk storage tanks are used to support filling of CO_2 extinguishers and for liquid storage in case of the need for fire suppression.
- **Shielding Gas Welding** — CO_2 is used as a shielding gas in mild steel MIG welding applications. Chart liquid cylinders, Perma-Max tanks and Bulk storage tanks are all used in this application depending on the scale of the operation.
- **Inert Enclosed Vessel Atmospheres** — Since CO_2 is inert and non-reactive, it is desirable to use in purging out flammable atmospheres in empty storage tanks or displacing air in beverage grade applications such as beer brewing. Chart tanks from liquid cylinders to Perma-Max tanks are used in these applications. Portable units including Orca™ trucks and trailers can also be used in this application.
- **Dry Ice** — Dry ice production facilities utilize Chart CO_2 Bulk storage tanks to supply liquid CO_2 into processors for making dry ice blocks or pellets.

- **Refrigeration** — R744 (CO_2) is refrigerant grade CO_2, used as a replacement for R134a and R404A in ultra-low, low and medium temperature refrigeration applications. R744 (CO_2) is becoming increasingly popular due to its excellent properties. With an Ozone Depleting Potential (ODP) of 0 and a Global Warming Potential (GWP) of 1, R744 (CO_2) is a natural refrigerant. Large grocery chains are starting to switch over to this type of refrigeration system. Chart is presently looking at this application to provide special tanks to recharge these systems when required.

Supercritical CO_2 Applications

- **Botanical Extraction** — Supercritical CO_2 makes for a very good solvent. As such, it is often used for the targeted removal of various components in plants such as CBD from cannabis leaves. Botanical extraction is also used for making perfumes, spices, medicine, etc. Although Chart presently does not sell equipment that provides CO_2 at supercritical pressures, Chart storage tanks, our Perma-Max 1400 XHP system, and the new Trifecta® Pro CO_2 are all used in this particular application.
- **Fusion Coolant System** — Supercritical CO_2 is used for cooling and lubrication for machine tools.
- **Foam Processing** — Supercritical CO_2 is used as a blowing agent for foam processing.
- **Decaffeination of Coffee** — Supercritical CO_2 is used to decaffeinate coffee.

For more information on Chart Industries, visit www.ChartBeverage.com

Product and Application Information: 1-800-247-4446