



KIDDE FIRE SYSTEMS

INTRODUCTION TO LOW PRESSURE CO2

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CO2 MYTH



- *“Everyone is buying FM-200® and CO2 is going away”*
 - Feb 2001, Anonymous Kidde Employee
- *“Halon will replace CO2”*
 - Kidde Employee, circa 1970 (attributed)
- *“Hey, I have something better than steam!”*
 - Walter Kidde 1917 (paraphrased)

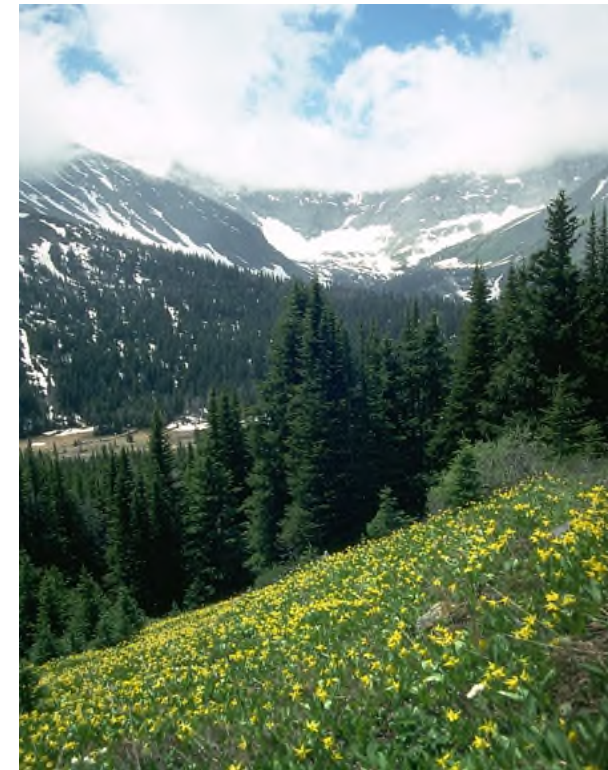
WHY CO2?

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- Original Clean and Green Suppression Agent
 - No Residue post-discharge
 - Nonconductive
 - GWP=1
 - ALT=N/A (Naturally Occurring)



WHY CO2?



- Versatility
 - Leak Tight Room Not Required
 - Addresses hazards with partial enclosures or unenclosed equipment
 - Extended discharge
 - Room not required!
 - Suitable for extreme temperatures

WHY CO2?



- Economical Solution
 - Ease of Recharge
 - Frequent discharge applications
 - Nearly universal access to CO2 globally
 - Simple re-fill process
 - Inexpensive to procure
 - No super pressurization required with agent propellant (N2)

CHALLENGE OF CO2



- Asphyxiate
 - Industry overall responsible with use of CO2
 - Follow NFPA 12 & KFS DIOM
 - Mechanical Discharge Delays
 - Lock Out Valves
 - Pressure Operated Sirens
 - Odorizers
 - Signage

**MANY SAFETY UPGRADES
NEVER COMPLETED**

CO2 APPLICATIONS



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Power Gen

Cement

Printing

Metal

- Turbine Generators
- Gas/Diesel Generator Units
- Hydroelectric Generators
- Electrical Equipment Rooms
- Lube Oil Rooms/Areas
- Coal Handling Systems
- Dust Collectors
- Exhaust Ducts
- Printing Presses
- Cold Rolling Mills
- Storage/Process Rooms
- Grinding/Machining Units
- Paint Booths



ELECTRIC UTILITIES – GAS TURBINES



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- Generator Enclosures
- Switchgear Rooms
- Lube Areas
- Bearings
- Generator Purge

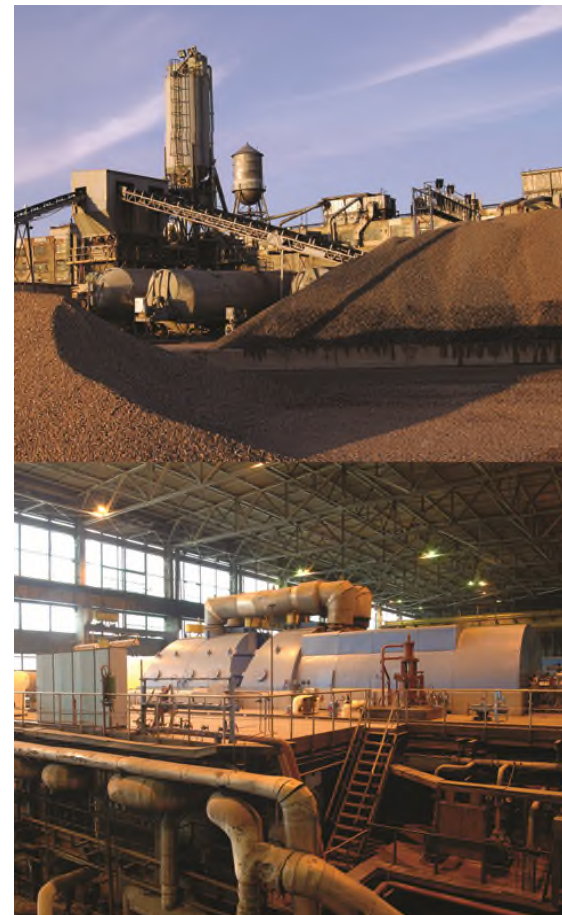


ELECTRIC UTILITIES - FOSSIL FUELS



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- Switchgear Rooms
- Dust Collectors
- Hose reels
- Inerting Systems
 - Pulverizing Mills
 - Coal Silos
 - Generator Purge



ELECTRIC UTILITIES - HYDRO



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- Generator Enclosures
- Switchgear Rooms
- Lube Areas
- Bearings



CO2 APPLICATIONS



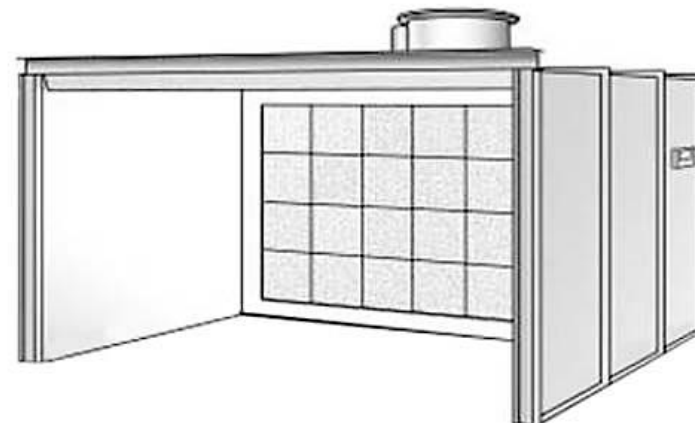
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CO2 APPLICATIONS



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 **Kidde**
Fire Systems

CO₂ STORAGE COMPARISON

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High Pressure



- < 4,000 lb (1,815 kg)
- 850psi at 70°F
- Main & Reserve banks
- Expels all CO₂ upon discharge

Low Pressure



- Refrigerated storage unit
- 300psi at 0°F
- Multiple discharges per tank
- Expels partial discharge

CO₂ STORAGE COMPARISON



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| HP | LP | System Features |
|-----|-----|--|
| YES | NO | Requires hydrostatic testing |
| YES | NO | Requires weighing to check contents |
| NO | YES | Delivers partial content discharge |
| NO | YES | Suitable for recharge on site |
| YES | NO | Factory filled with CO ₂ , DOT approval |
| YES | NO | Delivery lead time under 12 weeks |

CO₂ STORAGE COMPARISON

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CO₂ Suppression Systems

HP-CO₂

- Americas Compliant
 - DOT, TC
 - UL, FM
- EU Compliant
 - TPED, PED, ATEX

LP-CO₂

- Globally Compliant
 - FM
 - ASME Vessel

WHEN TO USE LP CO2



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- **CONSIDER LP CO2 for:**
 - Multiple Discharges Without Recharge
 - Fire occurrence history
 - Flammable materials
 - Clean-up time
 - Multiple zones
 - Hazard value
 - System Cost (Initial and Long Term Ownership)

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LOW PRESSURE CO2

CARDOX LPCO2 SYSTEMS



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Name to be changed to **Kidde Cardox**



HOW LP CO₂ WORKS



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Mechanical:

- **CO₂ Tank**

- Stores CO₂ at low temperature (0° F)
- Reduces pressure to 300 psi

- **Discharge Pipe**

- Routes agent to hazard when released

- **Discharge Nozzles**

- Controls the specific flow needed for that area

HOW LP CO₂ WORKS



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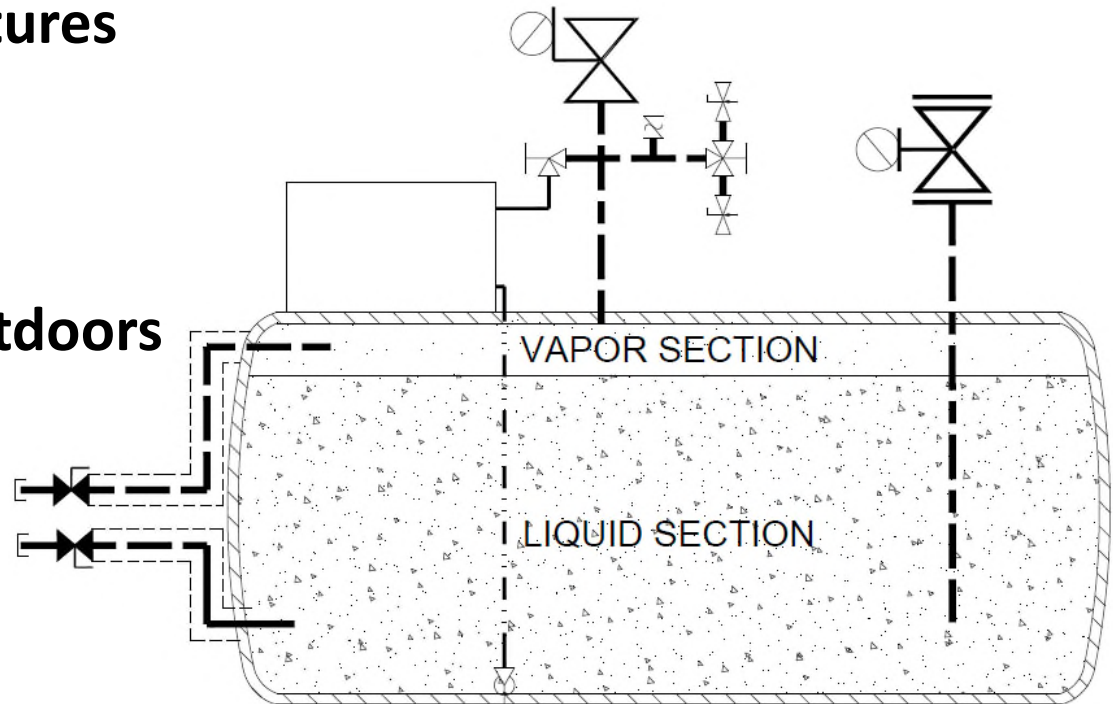
Electrical:

- **Control Panel**
 - Monitors detectors
 - Activates solenoids
 - Times release duration
- **Detection**
 - Monitors for fires
- **Notification Devices**
 - Warn personnel

LP CO₂ STORAGE CONDITIONS

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- **CO₂ storage**
300psi @ 0°F
- **Storage Location Temperatures**
-10°F to 130°F
- **Suitable for indoor and outdoors**
- **Shipped Empty**
- **Flow Calculation:**
 - 90% of tank capacity is available
 - Minimum pressure at nozzle 150psi



SIZING THE LP CO₂ TANK

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NFPA 12 does not require reserve

Suggestions:

- **Independent hazards** - 2 cycles largest hazard
Storage rooms, Switchgear rooms, Pulverizers
- **Adjacent hazards** - 2 cycles all adjacent hazards
Gas turbine, Test cells, etc.
- **Multiple local applications within 25 ft (7.6 m)** - 3
cycles largest hazard
Press lines, Fryers, Grinding Machines

ABC PRINTING PRESS SUMMARY

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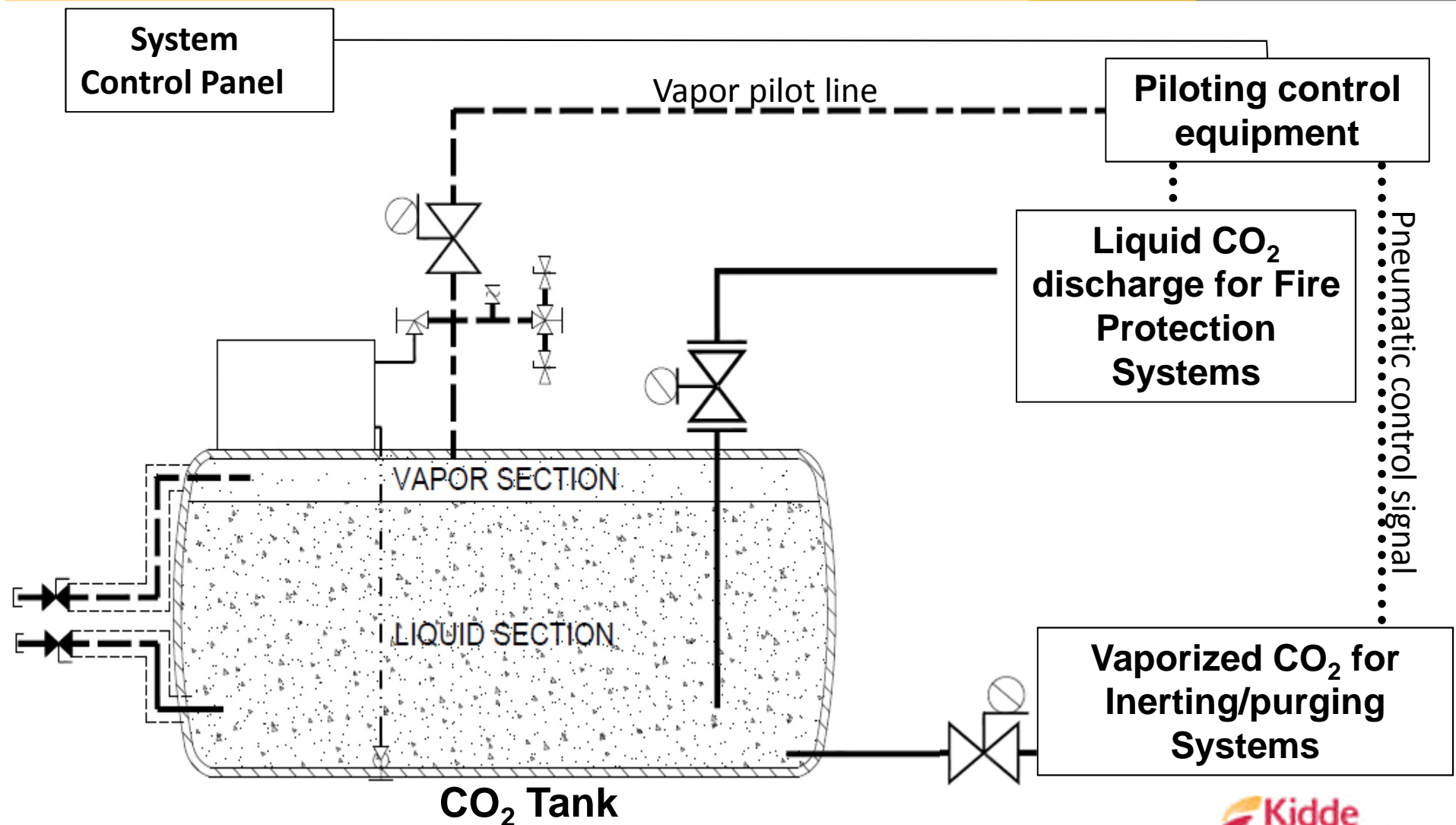
| Hazard | Method | CO ₂ Req'd | Flow Rate | Valve |
|--------------------|--------|-----------------------|--------------|-------|
| Open Coater #1 | LA&TF | 1,300 lb | 2,000 lb/min | 3" |
| Enclosed Coater #2 | LA&TF | 715 lb | 1,100 lb/min | 2" |
| Open Coater #3 | LA&TF | 1,170 lb | 1,800 lb/min | 3" |
| Enclosed Coater #4 | LA&TF | 585 lb | 900 lb/min | 2" |
| Open Coater #5 | LA&TF | 1,365 lb | 2,100 lb/min | 3" |
| Enclosed Coater #6 | LA&TF | 650 lb | 1,000 lb/min | 2" |

Largest Demand 1365 lbs x 3 cycles = 4,095 lbs.

Use 2¾ ton LPCO₂ Tank 4,950 lbs.

LP CO₂ SYSTEM SEGMENTS

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LP CO₂ EQUIPMENT - BASIC

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BASIC EQUIPMENT

Storage Unit with refrigeration system

Tank Shut-off Valve to isolate the tank with status switches

Cardox Valves to control flow of CO₂. Sized from ½" thru 6"

Supervisory Pressure Switch monitors the pilot pressure line

Safety relief valves emergency relief incase of overpressure

Orifice union in pilot line to restrict vapor pressure losses

Lockout valves disable discharges mechanically

Maintenance switch electrical disconnect solenoid to prevent agent release

OPTIONAL

Cold Weather Package equips tank with a heater and pressure build components, recommended when temperatures remain below 0°F (-17.8°C) for more than 48 hour durations

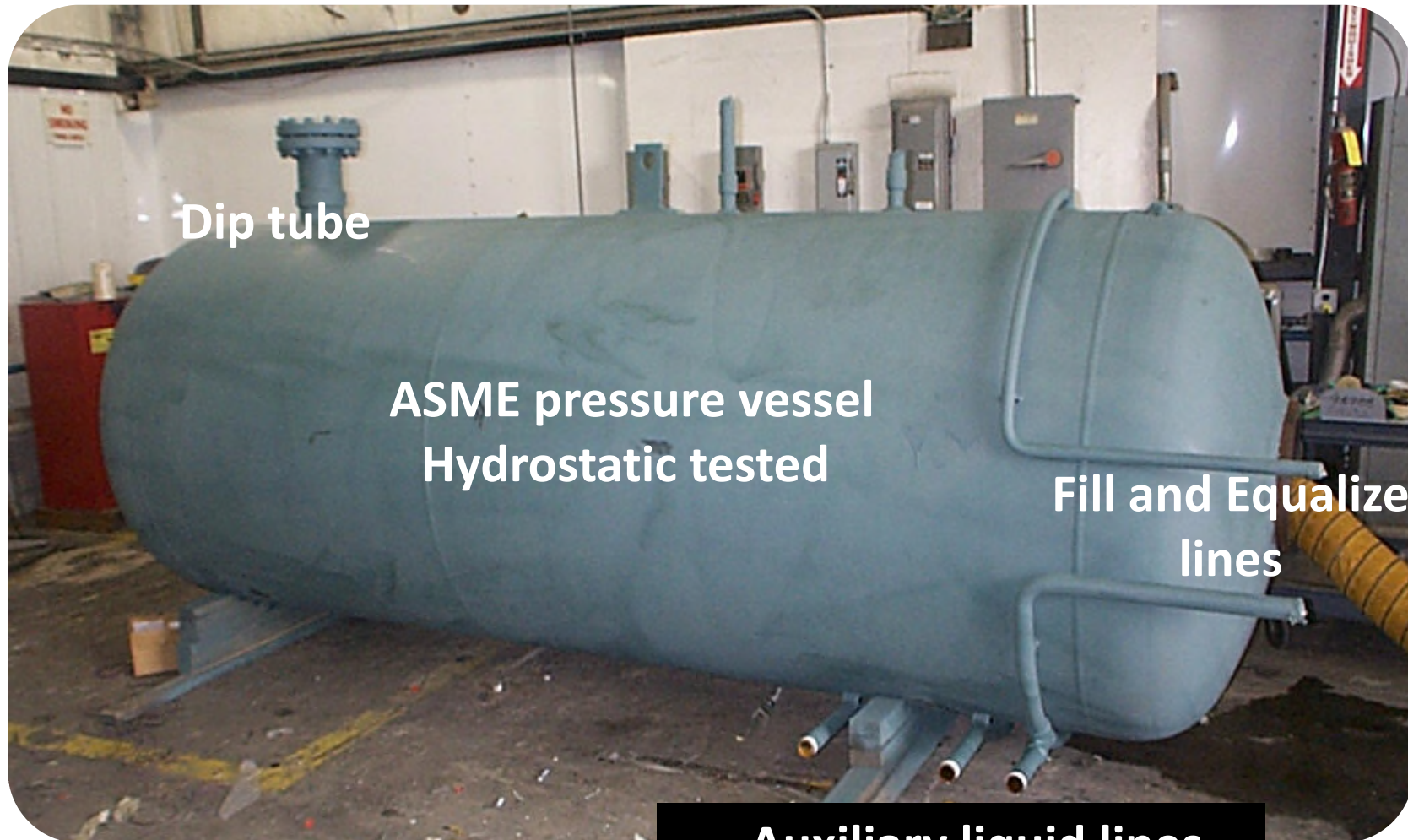
Alternate LLG available with contacts or 4 to 20 mA.

Foreign Approvals

Odorizer to scent migrated or lingering CO₂

INTERNAL PRESSURE VESSEL

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Auxiliary liquid lines

LP CO2 REFRIGERATION UNIT



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- Factory assembled refrigeration unit.
- Used to maintain pressure and temperature.
- Visual inspection.



LP CO2 STORAGE UNIT GAUGES

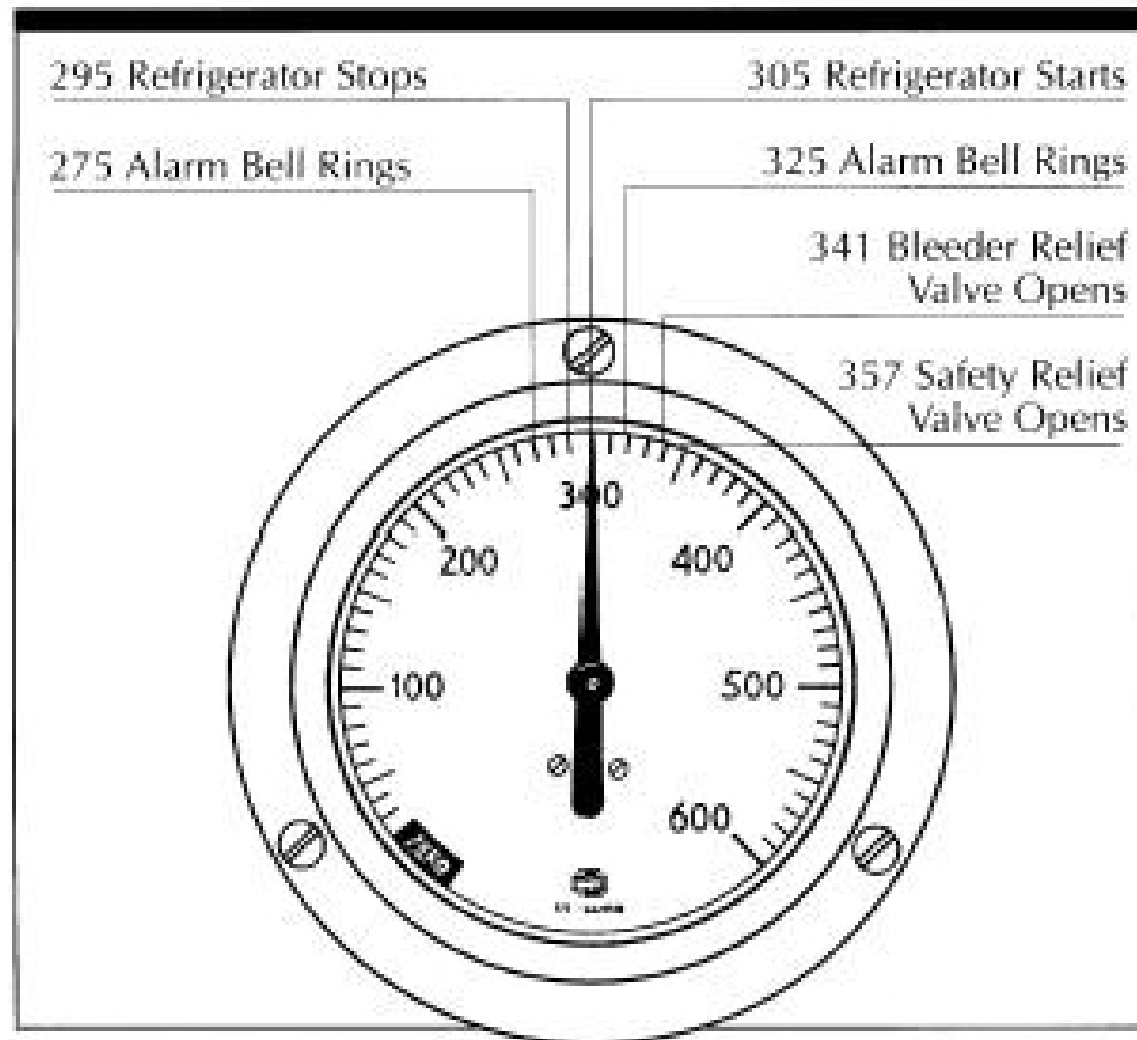
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- Liquid level gauge
 - Optional – 2 liquid level contacts
 - Optional – 4 - 20mA
- Pressure gauge



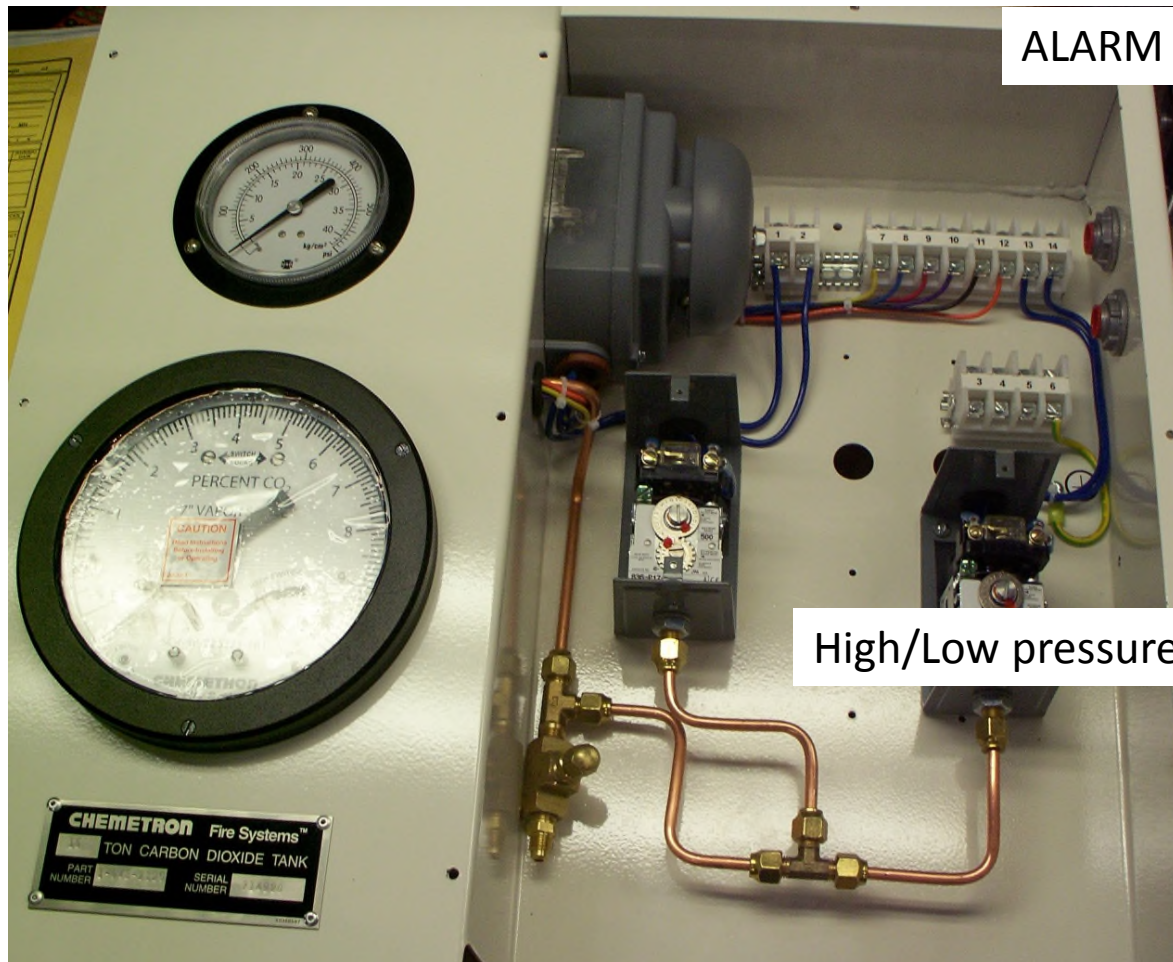
REFRIGERATION SEQUENCE

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TANK TROUBLE INDICATIONS

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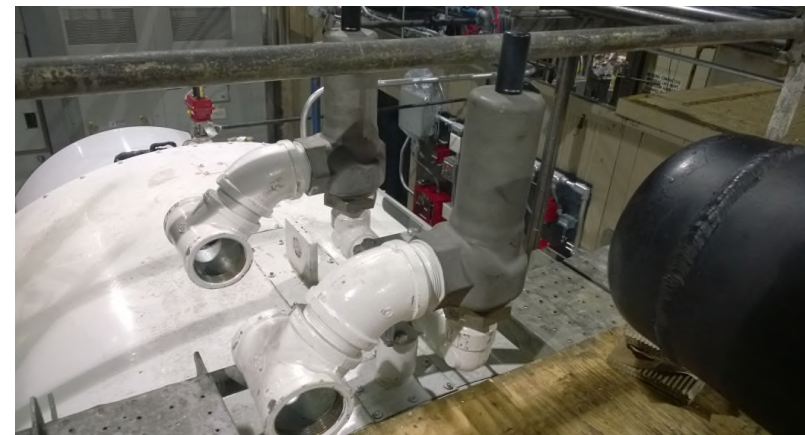
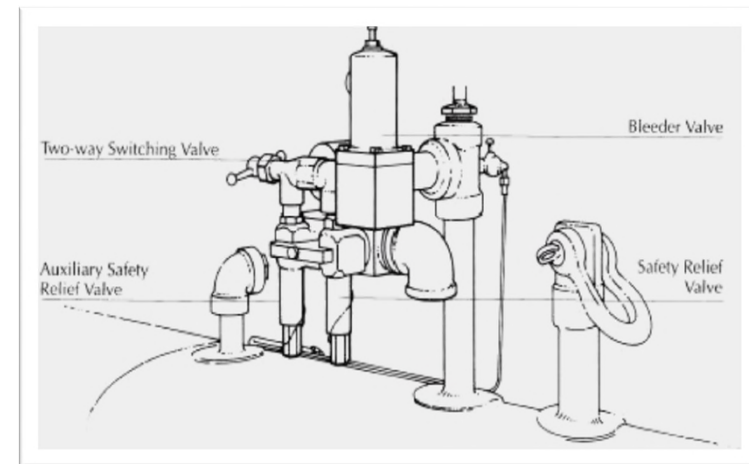
ALARM BELL

High/Low pressure switch

SAFETY RELIEF ASSEMBLIES

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- Bleeder Valve set at 341 psi
 - Opens to bleed CO₂ and self refrigerates
- Relief Valves set at 357 psi
 - Opens to vent tank vapor pressure
- Two-way Switching Valve
 - Allows for maintenance on dual relief assemblies



LP TANK FILL CONNECTIONS

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- 1" Vapor equalizing line with ball valve and CGA320 union connector
- 1½" Liquid fill line with ball valve and CGA320 union connector
- For indoor placement:
Extend lines, add remote valves, add safety relief valves and relocate union connectors

LP CO₂ TANK SHUTOFF VALVE

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- Normally open isolation valve
- Close valve for system maintenance
- Mate to dip tube flange
- Mounts between two flanges
- Manually operated
- 3", 4", 6", 8" diameter
- Wafer valve with lock hasp
- Status switch reports to control panel
- Acceptable for a mechanical lock-out for single hazard application



LP CO₂ STORAGE UNIT

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Tank Features:

- ASME pressure vessel
- Liquid level gauge
- Insulated and jacketed
- Refrigeration unit
- Internal refrigeration coils
- Discharge outlet (dip tube)
- Dual safety relief assembly
- Pressure gauge
- Fill connection (liquid)
- Equalization connection (vapor)
- Man-way access port
- Lifting brackets



DISCHARGE DELAY EQUIPMENT

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CO₂ Pneumatic Siren



Time delay (variable)



INSTALLED LP CO₂ UNITS

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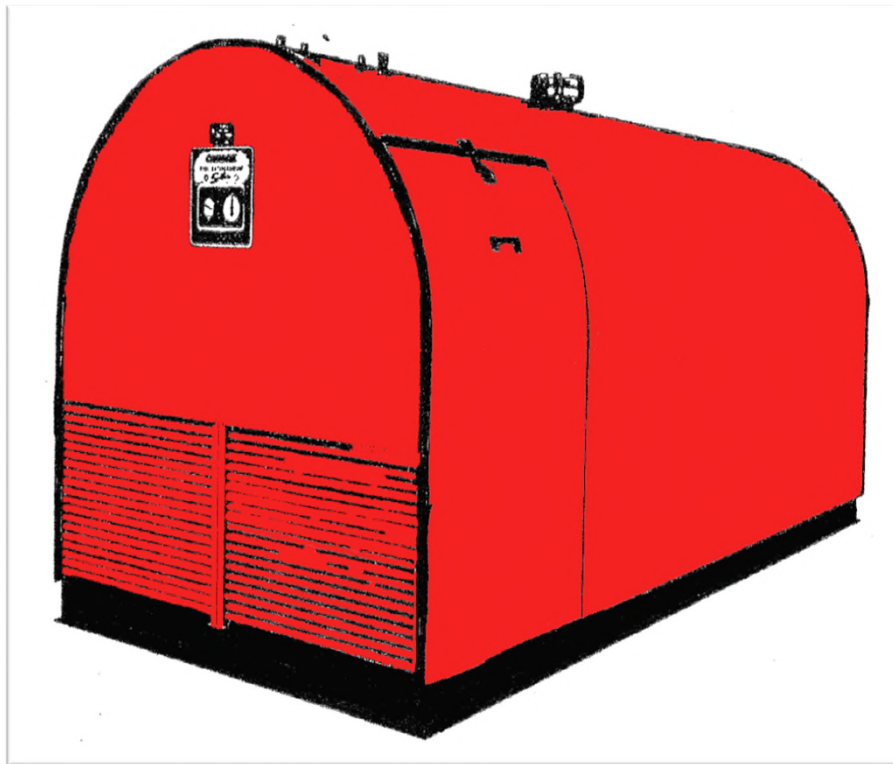
- **Original Tanks - Pre 1970's**
 - **Shrouded tanks**, steel jacket, 1¼ – 12½ ton, R-12
 - **Fiberglass covered tanks**, 13 ton and over, R-12
- **Intermediate Tanks - 1970 - Summer 2014**
 - **Top mounted refrigeration unit**, steel jacket, 1¼ - 10 ton, R-12 and R-404A, aluminum jacket, 17 - 45 ton, R-12 and R-404A
 - **Turbine skid package units**, steel jacket, 2¾ - 10 ton, R-12 and R-404A
- **Current Tanks - Fall 2014**
 - **Aluminum jacket units**, white finish, R-404A
 - + Horizontal units, front mount refrigeration, 2¾ - 60 ton
 - + Vertical tanks, 6" dip tube, 6 - 30 ton

LP CO₂ ORIGINAL STYLE

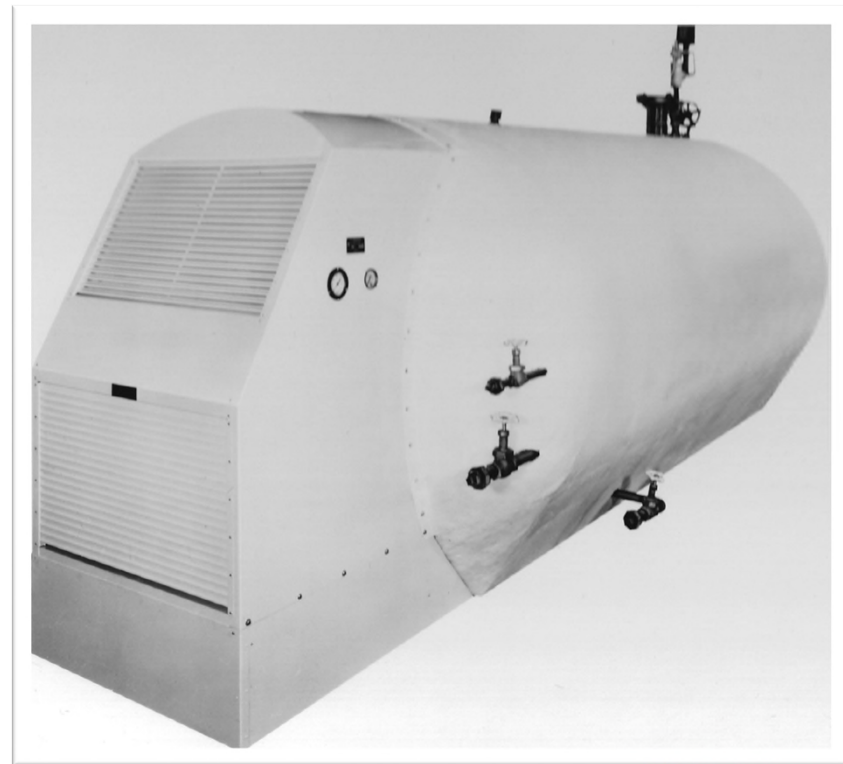
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Old Style Tank – Pre 1970's

Shrouded (mailbox)



Fiberglass



CARDOX LP CO₂ INTERMEDIATE

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Intermediate 1970 – Summer 2014

Standard

Turbine skids



CARDOX LP CO₂ CURRENT

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Current, Fall 2014 - Today Horizontal Units



Vertical Units





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COMPACT FOOTPRINT

- CO2 chilled to 0°F(-17°C)
- Packaged unit
- Horizontal or Vertical Installation

- Eliminates piping manifold
- Easily expandable
- Drop in Place
- 30%+ reduction in area



Sample Space Saving:

148,500-cu.ft hazard requires 6,750-lbm CO2
LPCO2 requires 91-sq.ft. VS. HPCO2 requires 148-sq.ft.

DESIGN FLEXIBILITY



- Multiple discharges without recharging
- Extended discharges
- Total Flood and Local Application



- Saves cost and space
 - No extended discharge manifold
- Continuous operation
 - Unit remains online
 - No cylinders to offsite re-charge location
 - Partial Discharges
 - Spurt & Squirt

LOWER MAINTENANCE



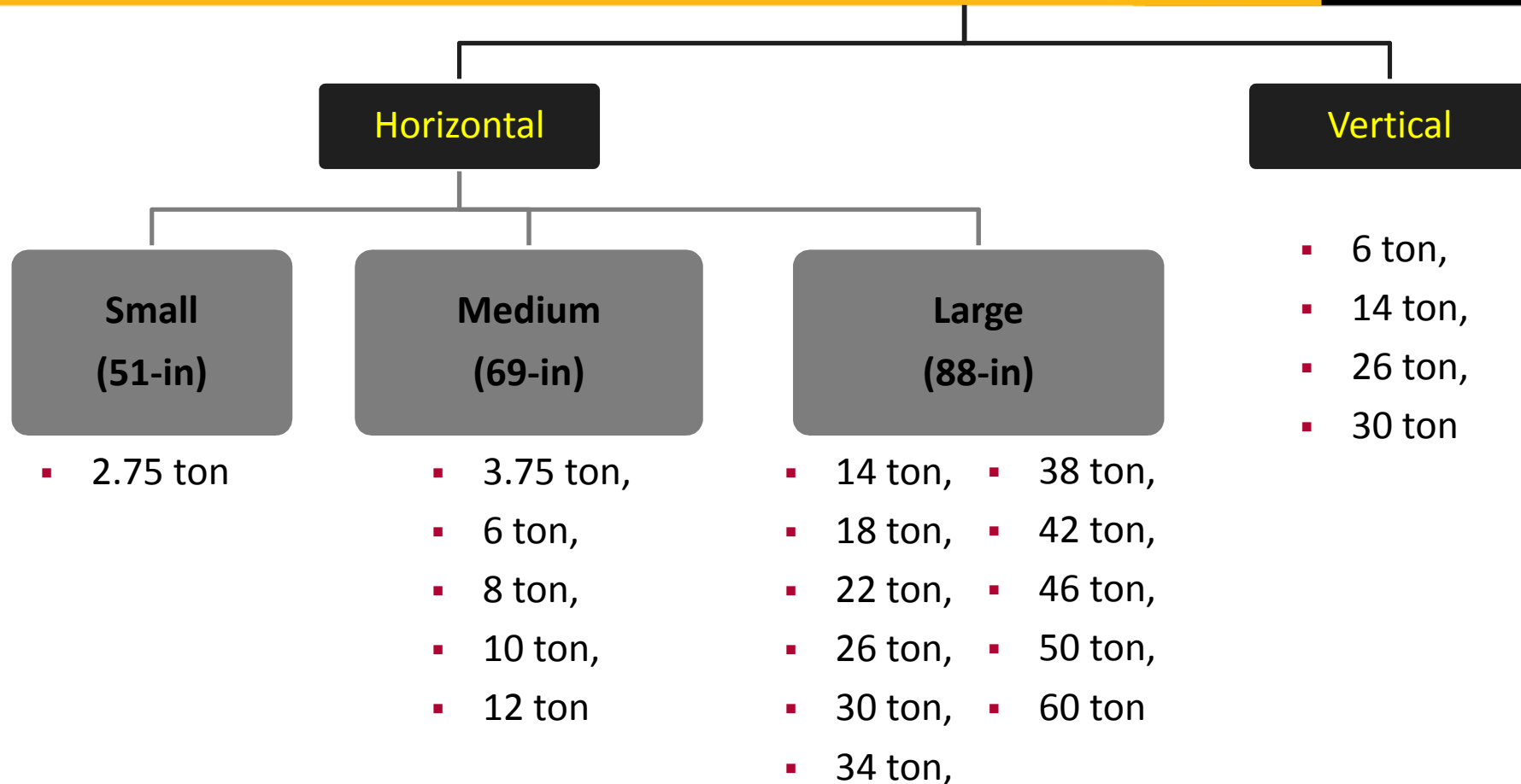
- Fewer tests required
 - No hydrostatic tests
 - Cylinders 5 or 12-yrs
 - Hoses 5-yrs

- Lower inspection costs
- Continuous operation
 - Dual safety relief valves
 - Unit remains online
 - No cylinders to offsite test location
 - No hoses to replace



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STORAGE TANK CAPACITIES



INPUT POWER TO SUIT GLOBAL MARKET



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- Variety of standard / stock refrigeration packages available
 - 50/60 Hz
 - Single or 3-phase
 - 110, 220, 380, 460 and 575 Volt

APPROVALS & LISTINGS



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- FM Approved for the following application environments
 - -10F to 130F storage range
 - Total Flood
 - Local Application
 - Hose Reel
- Optional certifications for global markets
 - Pressure Equipment Directive (PED)
 - Canadian Standards Association (CSA)



APPROVED TEMP RANGES



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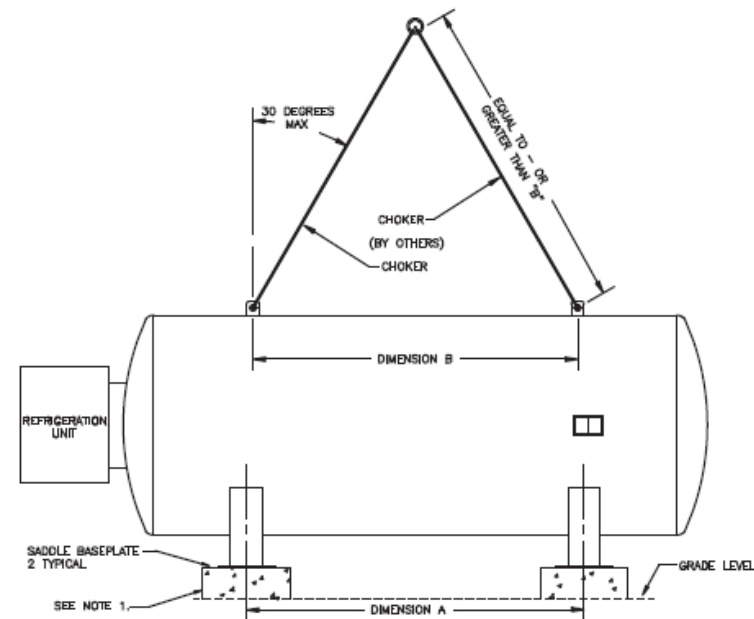
| Approved Temp | CARDOX | ANSUL | JANUS | TomCO2 |
|-------------------|-------------|-----------|-----------|-------------|
| Temperature Range | -10 to 130F | 0 to 120F | 0 to 130F | -10 to 130F |



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SHIPPING & HANDLING

- Lightweight Aluminum jacket reduces freight over steel construction
- Lifting lugs standard



ACCESSORIES

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- Standard:
 - 6-in diameter pressure gauge
 - Liquid level gauges
- Options:
 - Dual Contact (NO/NC) pressure & liquid level gauges
 - 4-20mA Contact pressure & liquid level gauges
 - Cold weather provisions for instrumentation and compressor (for applications below -5F)



DOWNSTREAM FEATURES

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Discharge Nozzles

- Radial, orifice & spot nozzles
- Carbon steel or stainless steel construction
- Flange mounting kits
- Total flood or local application use

Custom site specific solutions

Wafer Valves

- 3, 4, 6 & 8-in diameter sizes
- Carbon steel or stainless steel construction
- Optional limit switches (NEMA 4,7 & 9)

NFPA12 Safety Compliant

Hose Line

- 1-in diameter hose line
- 50, 100, 150 & 200-ft lengths available

Enhanced Flexibility

Selector Valves

- ½", ¾", 1", 1-½", 2" brass construction
- 3", 4" & 6" steel w/ corrosion protection

Multi-hazard protection

NOZZLES COMMON TO LPCO₂

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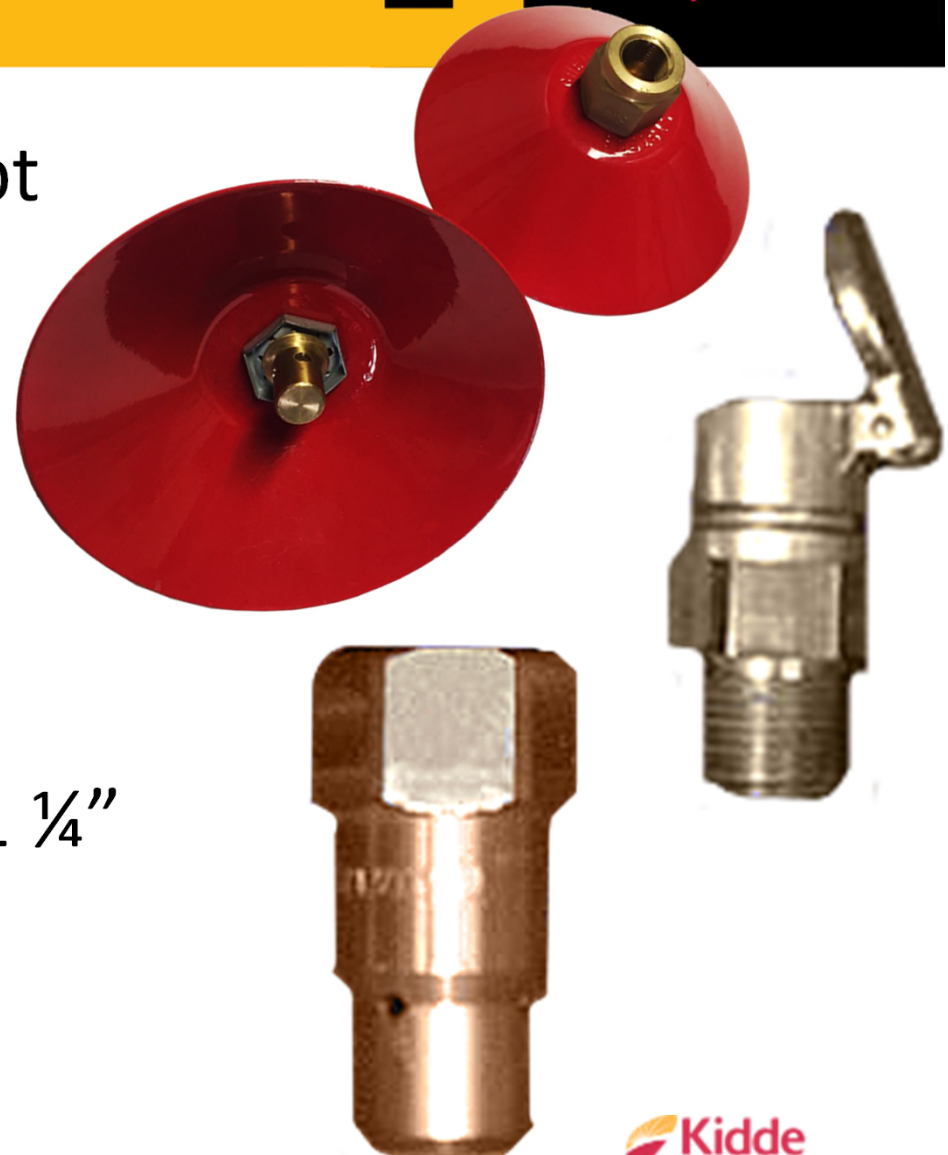
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CO₂ TOTAL FLOODING NOZZLE

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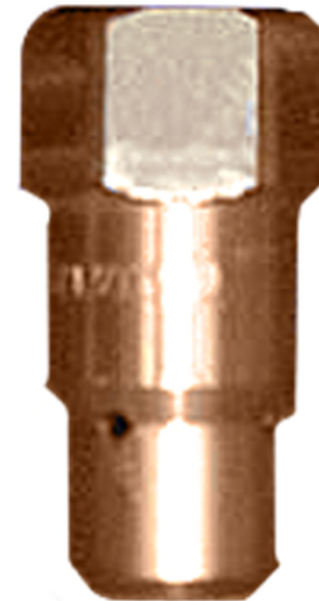
- Radial nozzles ½" – 2" npt
 - Open spaces
- Orifice nozzles ½" npt
 - Ducts, trenches, small spaces
- Wide angle nozzle ½" – 1 ¼" npt
 - High Ceiling Rooms



CO₂ RADIAL NOZZLE

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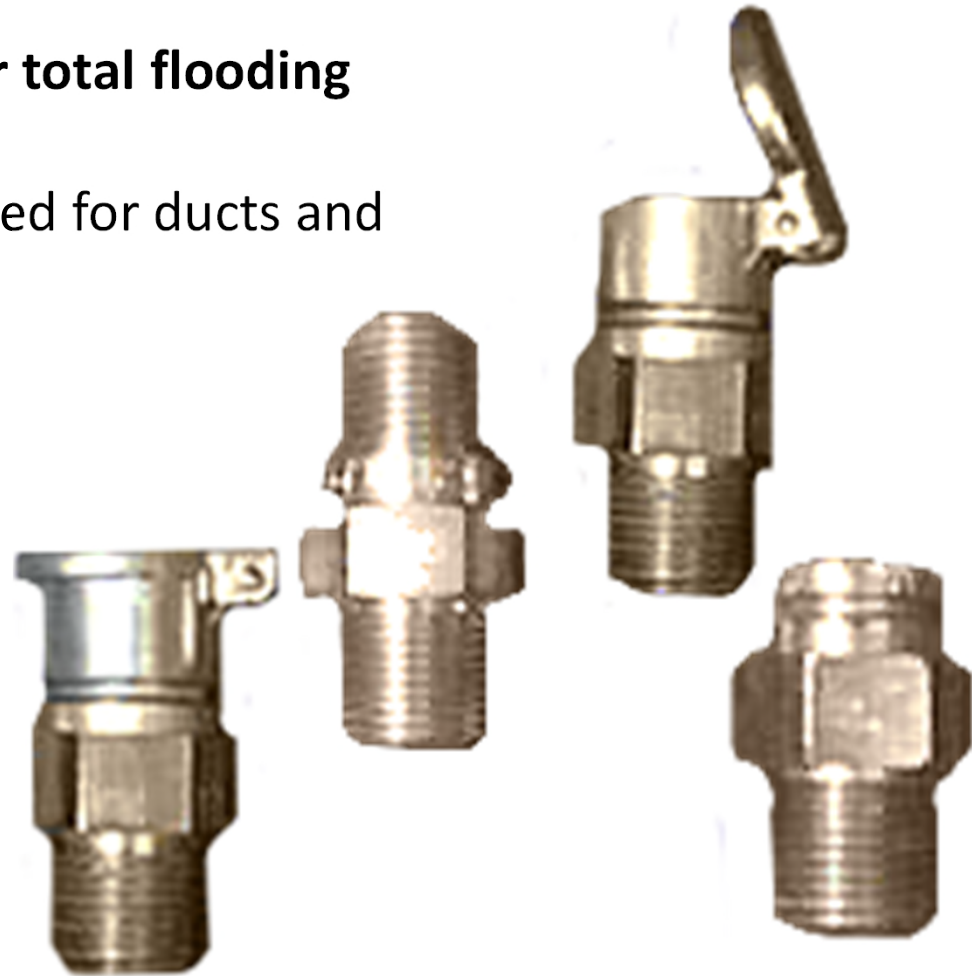
- Radial nozzles are **used only for total flooding**
- Appropriate for rooms, pits and tunnels where heights exceed 6 ft (2 m)
- Good when hazards are high in the room (racked storage, switchgear)
- Rated up to 40 ft X 40 ft X 40 ft
 - (12.2 m X 12.2 m X 12.2 m)
- Sizing ½" thru 2" NPT
- Flow rate range between
 - 10 lb/min - 1200 lb/min
 - (5.4 kg/min – 544.3 kg/min)



CO₂ ORIFICE NOZZLE

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- Orifice Nozzles are **used only for total flooding**
- Good for small confined spaces.
- Orifice nozzle with spring cap used for ducts and trenches.
- Sized for ½" npt only
- Flow rate range between
10 lb/min - 50 lb/min
(5.4 kg/min – 22.7 kg/min)
- Offered as:
 - threaded one end
 - threaded both ends
 - with spring cap



CO₂ WIDE ANGLE NOZZLE

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Wide Angle Nozzles **are used only for total flooding**, where the hazard remains low in the room (such as, flammable liquid storage rooms)

- 6" (15 cm) shell - ½" and ¾" npt connection
- 10" (25 cm) shell - 1" and 1¼" npt connection
- Maximum rated of 40' x 40'
 - (12.2 m X 12.2 m)
- Flow rate range discharges
 - 10 lb/min - 500 lb/min
 - (5.4 kg/min – 226.8 kg/min)



LOCAL APPLICATION NOZZLES

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Spot nozzles $\frac{1}{2}$ " – $\frac{3}{4}$ " npt

4" and 5 $\frac{1}{2}$ " Shell

2' to 8' distance

10#/min – 130#/min



Spotlet nozzles $\frac{1}{2}$ " npt

2 $\frac{1}{2}$ " Shell

Small spaces

10#/min – 50#/min

OTHER CO₂ COMPONENTS

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Hose reels





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QUESTIONS?