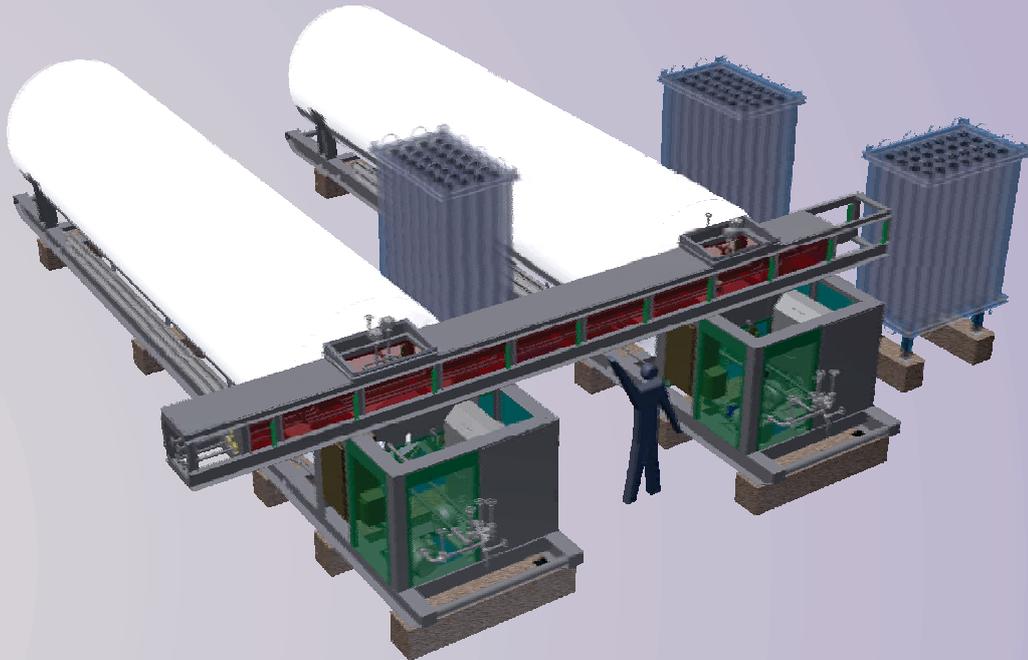


SPRUCE PRODUCT HANDLING AND STORAGE SOLUTION

Cosmodyne Packaged Plants offers a liquid storage, pumping and cylinder filling solutions. The innovative, skid-mounted system is engineered for the safe and efficient storage of liquid oxygen and liquid nitrogen in low pressure horizontal tanks. The package facilitates remote process monitoring, automatic pump cool-down and loss of prime protection, inventory control, liquid pump transfer to road tankers, high pressure pumping and vaporization for cylinder filling, as well as Off spec liquid disposal.



A range of features makes this storage and filling system efficient, versatile, moveable, safe and extremely cost-effective:

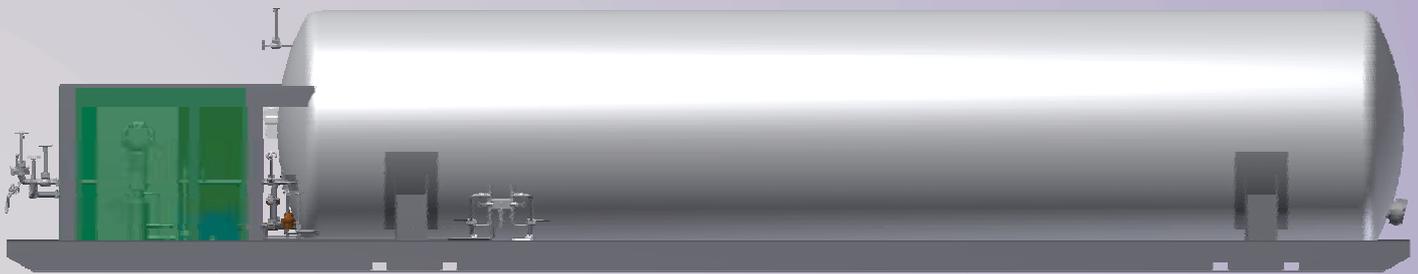
- Safe shipping and rapid deployment or relocation: The entire skid-mounted system slides into three 45 foot high-cube containers. Each skid can be moved with 2 forklifts.
- The packaged unit eliminates expensive onsite engineering and labor.
- Facility is provided to fill Road tankers, high pressure VIEs and Liquid Dewar's.
- An interface skid provides product piping insulation, flexible product connections to all the skids ,single point electrical and control connection to the package as well as halogen lighting.
- The PLC system allows remote dial in for analysis, problem solving, quality control and production trending for stock analysis.
- The HMI Touch screen is located in an IP55 dual door waterproof enclosure to allow easy access to the display.
- The PLC incorporates automatic cool down and loss of prime detection for all pumps and VFD control for the transfer pumps.
- Rigorous testing at the point of manufacture gives assurance of flawless and rapid commissioning in challenging or remote locations.
- Checked and tested: All electrical supply lines and controls are pre-wired and tested at the factory. The individual skids are pre-assembled and tested as a unit. Customers are invited to witness the testing first-hand.
- There is full independent control from both the main ASU plant PLC HMI and the local Tank HMI.
Each Tank will have its own independent S7-1200 CPU and 6" Touch screen HMI.

EACH PACKAGE INCLUDES:

- A interface skid to tie all components together, One Oxygen, One Nitrogen Tank, pumping skid, two HP vaporizer for cylinder filling and a dump vaporizer.

EACH TANK AND PUMP SKID CONTAINS:

- 25m³ vacuum + perlite insulated horizontal type storage tank designed to ASME sec. VIII div. I Edi.2010 with "U" stamp certification.
- Model AC-30 ACD transfer pumps with VFD controls for road tanker or VIE filling rated for 302.83 l/min at 14.077 m differential head in Oxygen service @ 2950 rpm. VIT Tank is designed in conjunction with the pump to ensure the correct NPSH requirements.
- ACD P2K cylinder-filling pump for cylinder filling (10 HP) features a vertical pump with a dual wrist-pin bearing design, allowing higher rod loading and greater drive-end life. Vacuum jacket at cold end minimizes the losses.
- A state of the art Siemens PLC Control System with HMI touch screen Electrical and PLC panels and all associated wiring inside the skids.



ADDITIONAL FEATURES:

- Each Tank has a pressure build up coil to allow for pressure decants from the tank if necessary.
- A VFD on the transport tanks maintains the required pressure without pump cavitation.
- Pump suction lines are rock-wool insulated with aluminum weather-proof jacketing.
- Independent liquid feed lines are provided to all pumps, facilitating separate operation of the Transfer pump and Cylinder Filling pump.
- Interface exists between the SPRUCE plant PLC and the tank PLC system so that both systems can be viewed from either location.
- The PLC includes the automatic cool down protection, loss of prime on both pumps as well as the tank level and pressure indication.
- HMI screen incorporate a sun shield for easy viewing in bright environments.
- The PLC can be linked to the Cosmodyne SPRUCE Plant PLC.
- Each individual tank skid can be controlled from the main plant PLC by means of ethernet connection.
- The design includes safe disposal of liquid from safety and vent valves and easy access for equipment maintenance.

Available Options

- Different pumps can be supplied and matched to the users requirement.
- The scope of the Tank Farm can be customised to user requirements.
- Optional Cylinder filling process economizer with Liquid pump Cycle achieving a 25% Specific power saving on the spruce plants. This system recovers refrigeration duty of the cold liquid being pumped into cylinders. When filling High pressure gas cylinders the cold liquid is pumped by the High pressure pump on the tank farm to 2500psi. The cold liquid is then exchanged against High pressure air from the plant in an insulated Air to product exchanger, the cold high pressure air is then fed back into the process, thus recovering refrigeration from the cylinder filling liquid and drastically reducing the specific power of the plant. If the Plant is off then cylinder filling can be accomplished through the ambient vaporizer. The System can be set up to either produce additional Nitrogen or Oxygen Liquid.

TRANSFER PUMP - ACD- MODEL AC30



SPECIFICATIONS

Flow Range	gpm	16-630
	lpm	60-2350
NPSHR	feet	2-12
	meter	0.6-4
Differential Head	feet	20-700
	meter	6-210
Pump Design Rating	hp	3-100
	kw	2.2-75
Speed Range	rpm	1450-7200

APPLICATIONS: Liquid storage transfer, Process plant, Truck and trailer unloading and Tank car unloading.

LIQUID PUMP: Nitrogen and Oxygen.

FEATURES AND BENEFITS:

- Closed Coupled design Provides:
 - Operations at high efficiencies.
 - Fewer Moving Parts.
 - Lower maintenance cost.
- Shaft seal design (mechanical, gas riding or labyrinth) are state-of-the-art and prolong life without leakage.
- VFD compatibility allows for multiple operating speeds.
- Minimum recirculation wear rings reduce maintenance requirements and improve efficiencies.

TYPICAL SCOPE OF SUPPLY:

- Pump and TEFC electrical supply.
- Long life CFS mechanical seal.
- Motor and seal purge ports.

OPTIONAL ACCESSORIES:

- Labyrinth Seal(dual,single).
- Gas riding seal.
- Pump skid.
- Automatic control system.
- Purge, seal and recommended spare parts skid.

CYLINDER FILLING :ACD - MODEL P2K



SPECIFICATIONS

BORE x STROKE	in	1.25,1.50x1.50	1.75x 1.50	2.00x 1.50
	(mm)	(32,38x38)	(44.5x38)	(50.8x38)
Flow Rate	gpm	1.13-3.10	2.20-4.20	2.87-5.53
	lpm	4.27-11.73	8.32-15.89	10.90-20.93
Pump Design Rating	hp	7.5-20	10-20	15-20
	kw	5.6-15	7.5-15	11.2-15
Maximum Discharge Pressure	psi	6000	45000	3500
	bar	414	310	241
NPSPR	psi	2	2	2
	bar	0.14	0.14	0.14
Maximum Suction Pressure	psi	300	300	300
	bar	20.7	20.7	20.7

FEATURES AND BENEFITS:

- Vertical pump design eliminates gravitational loading on the piston, extending sealing ring life and providing smoother suction valve operation.
- Vertical installation offers less vibration, reduced noise, and a compact system footprint.
- V-band clamp secures the sump to the intermediate, allowing quick and easy access to the cold end assembly.
- External re-lubrication nipples for roller bearings and crosshead provide extended service life.
- Packing rings at the top of pushrod are retained in cartridge for easy replacement.

APPLICATIONS: Heavy Duty cylinder filling, Medium duty storage filling and Unattended, automatic storage filling.

LIQUID PUMP: Nitrogen and Oxygen.