



- Geothermal Heat Pumps
- Packaged & HVAC Chillers
- Vapor Recovery Systems

## New Gasoline Vapor Recovery Technology Successfully Tested

Edwards Engineering and Praxair Corporation are pleased to announce a simple, safe and economical retrofit package for all existing VC, DE and DEC vapor recovery units, as well as a new Cryomechanical vapor recovery system. This system combines Edwards experience in low temperature condensation along with Praxair's experience in applying Liquid Nitrogen (LN2) to various applications. This package can be applied to all types of vapor recovery equipment currently in service. It has been successfully tested at two locations. A summary copy of test data is shown below.

Test Date: 6/4/93

HOURLY RESULTS Hour	HC Emissions		Gasoline Loaded (gals)	mg/liter	HCInlet Mass (grams)	HC Vapor Recovery Eff. (%)
1 Interval 1-12	1,901,662 mg	4.19 lb	90,550	5.55	126,233	98.5
2 Interval 13-24	947,165 mg	2.09 lb	87,460	2.86	104,476	99.1
3 Interval 25-36	482,745 mg	1.06 lb	60,800	2.10	67,410	99.3
4 Interval 37-48	299,900 mg	0.66 lb	44,500	1.78	28,816	99.0
5 Interval 49-60	680,193 mg	1.50 lb	65,200	2.76	94,698	99.3
6 Interval 61-72	605,549 mg	1.33 lb	54,597	2.93	66,576	99.1
<b>Totals</b>	<b>4,917,214 mg</b>	<b>10.84 lb</b>	<b>403,107</b>			

Total Gasoline Loaded	403,107 gallons
	1,525,760 liters
Gasoline Loaded into Leak Free Trucks	391,247 gallons
	1,480,870 liters
Overall Gallonage Weighted Average Hydrocarbon Emissions	3.22 mg/liter
HC Average Emission Rate	1.81 lb/Hr



- Geothermal Heat Pumps
- Packaged & HVAC Chillers
- Vapor Recovery Systems

## **WHAT IS IT?**

This package consists of a set of add-on cooling coils that will cool the -100°F effluent vapor from an existing Edwards unit to -180°F. The LN<sub>2</sub> that is required for this additional cooling is supplied by a free standing LN<sub>2</sub> tank. This LN<sub>2</sub> is supplied by Praxair while the necessary cooling coils, controls, and other hardware are supplied by Edwards. The entire package is warranted by Edwards.

## **WHY DO YOU NEED IT?**

The purpose of the liquid nitrogen add-on condensing unit is to bring the recovery performance of the existing equipment into compliance with the environmental performance now being proposed for various sections of the country. New units will also incorporate this technology.

Between 1974 and the present, more than 250 gasoline vapor recovery units have been installed by Edwards Engineering. These units were designed and built based upon the use of low temperature refrigeration equipment that cools and condenses the gasoline vapors as they are expelled from the gasoline tank trucks during loading.

A typical refrigeration vapor recovery unit can cool the vapors down to -100°F. At -100°F more than 90% of the gasoline vapors are condensed and recovered and emissions are less than 35 mg/liter. Throughout the country environmental officials are now ruling that still more of the gasoline vapors shall be recovered. The present mandated recovery does not appear to be acceptable and new standards ask for 10 mg/liter or less.

In addition, the LN<sub>2</sub> system is designed so that it is large enough to handle the entire terminal throughput should the mechanical system be inoperable. This has the advantage of effectively being an installed spare.

## **WHAT ARE THE OPERATING COSTS?**

The following information is based on four months of field data collected from a gasoline terminal having a truck loading capacity of 1,000,000 gallons per day and operating at less than 10 mg/liter of hydrocarbons in the effluent. The information shows the recovery rate of the liquid gasoline in gallons per day, and the cubic feet of liquid nitrogen required per day to operate the liquid nitrogen add-on condensing coil.



- Geothermal Heat Pumps
- Packaged & HVAC Chillers
- Vapor Recovery Systems

**ELECTRICAL COSTS**

Electrical costs are already known to average 1.25 Kw per 1,000 gallons transferred. Based on an average cost of .15/Kw hr., the daily cost is:

$$\frac{1,000,000 \text{ gal.}}{1,000 \text{ gal.}} \times \$ .15/\text{Kw hr} = 150.00 \text{ day}$$

**NITROGEN COSTS**

Based on the field data, the LN<sub>2</sub> usage for the system as defined above is .0487 Ft<sup>3</sup>/gallon transferred and the daily cost is:

1,000,000 gal	X	.048 Ft <sup>3</sup> LN <sub>2</sub> /gal	X	\$.007 Ft <sup>3</sup>	=	\$ 336.00 / day
Tank Rental					=	\$ 66.00 / day
						\$ 402.00
			Total			\$ 402.00

**GASOLINE RECOVERED**

Refrigeration Unit		1,276 gallons		
LN <sub>2</sub> Unit	+	81 gallons		
		1,357 gallons		
Total				
	X	\$ 2.80 / gallon		
	=	\$ 3,799.60 /day		

Net Payback		\$ 3,799.60 /day		
	-	\$ 150.00 /day		
	-	\$ 402.00 /day		
		\$ 3,247.60 /day		



- Geothermal Heat Pumps
- Packaged & HVAC Chillers
- Vapor Recovery Systems

**HOW IS IT INSTALLED?**

The retrofit package is supplied as a skid mounted package approximately 4'W x 4'L x 8'H for single coil units and 8'L for dual coil units. All piping and wiring is complete within the package. The following connections are required:

1. Vapor inlet connection from existing unit vapor outlet
2. Condensed gasoline/water drain connection to existing decanter
3. Single point power connection
4. LN<sub>2</sub> inlet connection

All of the above equipment is supplied by Edwards in the retrofit package. Installation should be by local service personnel with start-up assistance supplied by Edwards if requested.

In addition, an LN<sub>2</sub> tank will be required. This will be supplied and installed by Praxair after you have provided a concrete slab per specifications. This tank is maintained and refilled by Praxair. Approximate dimensions are 6' x 6' slab x 20' tank height.

**PRICING**

<b>Terminal Size - Gal/Day</b>	<b>Single Coil</b>	<b>Dual Coils</b>
250,000	\$ 96,000	\$ 156,000
500,000	\$ 118,000	\$ 196,000
1,000,000	\$ 136,000	\$ 230,000
2,000,000	\$ 166,000	\$ 310,000