



# Carbon Dioxide Project Profile

**Year Built:** 2015

**Engineering:** Carnot Refrigeration  
Neelands Refrigeration

**Installation:** Neelands Refrigeration

**Service By:** Neelands Refrigeration

**Refrigeration Capacity:** 25TR @ 5 C  
20TR @ 0 C  
17TR @ -5 C

**Production Capacity:**

2015 - 120,000L

2014 - 70,000L

**Marynissen Estates  
Niagara-on-the-Lake  
Ontario, Canada**



## Project:

Design, build of the fermentation process refrigeration system using a Carbon Dioxide chiller. System design also includes new heating and cooling glycol loops, heat recovery and controls. This project represents the first use of CO2 as a refrigerant in the winery market in Canada and to the best of our knowledge, North America.

## Customer Business Challenge:

Chief Winemaker, Gordon Brown, a long time and well respected winemaker in Niagara Region required a refrigeration solution that provided;

- reliable refrigeration
- accurate temperature control of the tank jackets to ensure an effective fermentation process
- energy efficiency with the refrigeration system
- use of available heat recovery
- elimination of future refrigerant management issues

.....and an environmentally acceptable solution that is in alignment with MaryNissen corporate sustainability objectives.



**ENGINEERED FOR  
PERFORMANCE**

## System Capacity:

The system production capacity is 23 tanks and 120,000 litres.

## System Configuration

### CO2 Chiller



The CO2 chiller is manufactured by Carnot Refrigeration based in Trois Rivieres, Quebec. The chiller design and engineering is completed by Carnot. The chiller system utilizes a single Bitzer reciprocating semi hermetic compressor with a refrigeration capacity for this installation to 25 TR. Alongside the compressor is a VFD which ensures efficient performance between 30% and 100%. Furthermore, the compressor is designed to operate in an “overdrive” condition to 70 hertz if required. The stainless steel coil gas cooler (condenser) is located outside the fermentation building adjacent to the chiller.

### What This Means to the Customer

The hydro consumption shall be assessed until June representing the full season cycle. A straight year over year comparison is not as simple as production has increased significantly. However, preliminary reviews of hydro bills versus the litres being produced would indicate a very good kW/litre ratio due to the chiller ability to accurately match demand. The chiller itself is packaged extremely attractively making it a placeholder in our guest plant tours.

### Chiller Heat Reclaim

The Carnot chiller incorporates high grade heat reclaim. The available heat actually exceeds the current requirements of the winemaker. Total available heat is approximately 400,000 BTU's. The heat reclaim is used for the hot glycol loop which serves the tank jackets eliminating the need for a boiler. The winery received an incentive from Enbridge gas for this design application. The onboard controls manage and integrate the refrigeration and heat reclaim requirements ensuring timely response and energy efficiency.



### What This Means to the Customer

The customer has increased production almost twofold and eliminated the need for a process boiler. They have realized a real decrease of over 40% in their gas utility costs and potentially a further cost avoidance savings of another 40%. Though final 2015/2016 production values and costs per litre are to be finalized, it is clear that this utility metric will represent a best in class practice. In addition, the heat reclaim will reduce the carbon emissions significantly over a traditional refrigeration system. The “blue sky” goal is that future wineries can incorporate other sustainable design measures along with CO2 as the refrigerant to achieve near Net Zero emissions.

## Glycol Hot/ Cold Loop

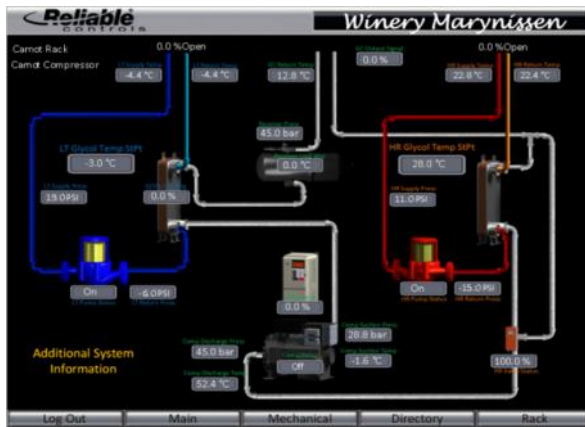
Each fermenting tank has a glycol jacket. Each jacket is served by both a hot and cold glycol loop that incorporates three way Belimo valves and custom Neelands control system.

### What This Means to the Customer

The vast majority of “estate wineries” use a spate loop for heat and for refrigeration with each of those lines having manual valves and connections at each tank or sequence of tanks. Each change requires labour and takes time. Many wineries have no heating/ cooling jackets relying on Mother Nature’s conditions presented or the temperatures that are maintained within the facility. This loop design and automated valve arrangement provides the winemaker with precise temperature control within jackets thus ensuring effective control of the fermentation process.



## Controls & Automation



The hardware and software platform for the Neelands custom control solution at the winery is Reliable Controls. The system is robust, flexible and an open platform. The Neelands in house control design team and some of Neelands refrigeration performance optimization tools were also implemented.

### What This Means to the Customer

The control system provides the winemaker with unparalleled visibility, reporting, historical analysis and performance.

The control system is mobile enabled providing the winemaker and his key staff with real time/ full time - access and control capabilities.

When compared to typical winery systems the overall efficiency, performance, environmental and product quality benefits of using CO2 as the primary refrigerant position this customer to increase his sell price.



Reducing production costs and raising sell price is an outstanding result.