Winery – New NH_3 Chiller

Winery – New NH_3 Chiller

Sirromet Winery is located about 40km south-east of Brisbane near Mount Cotton and one of Queensland's largest wineries (www.sirromet.com.au).
Sirromet are committed to reducing there carbon footprint and to produce the first carbon neutral wine in Australia.
The first major step in achieving this was to replace an existing York R22 chiller as this equipment was over 15 years old, had high running cost levels and capacity limitations.

Sirromet's winery is set up for a 2000 ton crush with 97 stainless steel tanks ranging from 3000 litres through to 120000 litres.
The system comprises a remote central refrigeration chiller and primary pumps in a closed loop reticulation loop with a 25,000 litre insulated buffer tank. Alcool LF is the re-circulated cooling medium used due its low viscosity and high heat transfer characteristics at sub-zero temperature. The buffer tank has a number of supply pumps which are designated to areas and operate as required.

Both supply and return Alcool LF end in the tank with a sizable internal separating distance. Additionally, there is a tank farm near the chiller which has dedicated supply pumps that interconnect local pipe mains and thus do not emanate from the main buffer tank.

Chiller - Green and Gold

Sirromet wines demonstrated their willingness to accept the challenge of reducing their carbon footprint by installing an ammonia chiller system.
Ammonia is one of the original refrigerants and has withstood the changing times of varying Freon refrigerant changes. It has an ODP (ozone depletion potential) an GWP (global warming potential) rating of 0 and is highly regarded for its superior heat transfer characteristics, lower run costs and ease of detection
Modern ammonia systems fit well with a carbon emission reduction blueprint. As a refrigerant it can rightfully claim as being an environmentally friendly refrigerant.
.

Refrigeration Duty

The following Sirromet refrigeration duty was estimated after extensive analysis and load profile plotting.

440 kWR	Maximum Peak Load (Spiraflow Operational)
190 kWR	Medium Load (Spiraflow Non Operational)
100 kWR	Low Load (Spiraflow Non-Operational)

.

Refrigeration Equipment Design

Bitzer Australia worked closely Gordon Brothers the nominated contractor on the design and equipment requirements

The design brief was a broad range flexible system to achieve a stable supply temperature in the most cost effective manner. The quality of the program in the PLC is the key in maintaining low operating costs and stability. The equipment chosen includes the following:

Bitzer Australia's Duo-NH_3 Package (front)

1. Two (2) Bitzer screw compressors OSKA8561, operating in tandem offering a total turn down ratio of 8:1. This represents a minimum capacity of 60 kWR with one base load compressor operating. The system duty is such that for a larger proportion of time, the chiller will operate on one base load compressor. The control of this base compressor is important given the adequate size of the buffer tank.

2. A variable speed drive on the base load compressor provides control accuracy with efficiency gains. The combined capacity control function of compressor unloading and motor speed regulation is the secret. Overall this produces both an accurate supply temperature at the least running cost.

3. One (1) Aqua Cool evaporative condenser for heat of rejection. Evaporative condensers rely on an adiabatic process

enabling lower condensing pressures than air cooled systems. This means a lower compressor compression ratio with reduced energy cost per every kW of refrigeration.

4. A variable speed drive for the condenser fan enables motor speed regulation to maintain adequate condenser pressure. Overall this produces stable pressure at the least running cost. The fan produces a power saving ratio of a cubed root to the fan speed. Meaning ½ fan speed equals 1/8 fan power use.

5. Alan Bradley PLC controller and HMI interface panel. The controller manages all functions including supply temperature, auxiliary controls, safety and alarms. The control logic was specifically written by Bitzer Australia

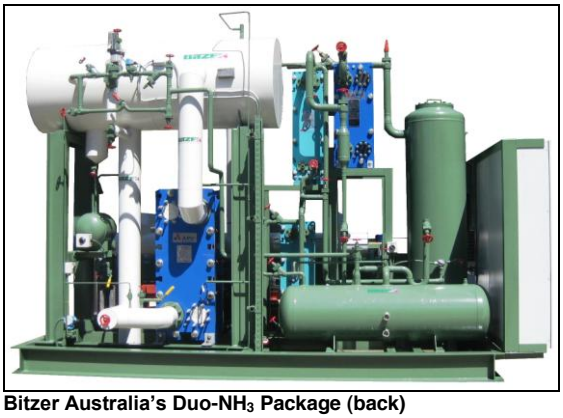
Refrigeration System Comparison

The key in maintaining low operating costs is the stability at which the equipment functions over its' broad range. Actual system comparisons and run cost predictions is always difficult and can be wildly exaggerated. Both systems need to be identical in refrigeration output and capacity reduction stages to properly evaluate.

A number of conflicting factors need to be considered. The condition of the existing old equipment and outmoded technology will reduce its' efficiency. The new chiller being rated at a higher capacity may cause a longer run time and thus consume more energy to achieve better temperature results. The best way to compare performance is with identical machines operating at the relevant conditions.

Based on Sirromet's average medium load run time, the theoretical estimated cost saving for the new ammonia chiller system is in the order of up to 32% per annum. This represents savings of up to $20,000 per annum based on a reasonable electrical cost rate.

The existing system had an Alcool LF supply flow of 17 l/s at -6°C to maintain cooling. The new system has a primary Alcool LF supply flow of 33 l/s designed at -6°C. Through chiller tests it was found that Alcool LF could be supplied at -4°C and maintain adequate cooling with a better recovery period.



Bitzer Australia's Duo-NH_3 Package (back)

Heat Recovery

The system incorporates a complete heat recovery system to maximise the absorption of the available system heat of rejection. The ammonia screw compressors reject heat conventionally through the condenser and the oil cooler. The system is connected to prioritise the heat rejection to an ammonia de-superheater and an oil cooler recovery unit. Water is reticulated from a tank through the two heat exchangers to deliver a minimum temperature of 60ºC across most of the duty range.

The heat efficiency gain will increase the more the compressors are capacity loaded. The heat recovery system is used for pre-heating water for the gas fired boilers. The system is designed for 85 kW which equates to a gas saving of up to $22,000 per annum depending on demand.

Installed System at Sirromet Wine

Reduction in GHG or CO_2 Emissions

The Change from air-cooled system to a NH3 system has seen the CO_2 emissions drop by 0.35kg of CO_2 per every 750ml bottle of wine. On an average production of 1000000 bottles, that is a reduction of 350tons of CO_2 emissions. The action stemmed from Sirromet's work on their carbon footprint, which established that electricity usage was high and action needed to happen.

The Chief Wine Maker

Adam Chapman says that during vintage the new plant runs like a dream. “It is quiet, efficient, very powerful and, yes, smart too! When needed the power is there within three minutes, fully loaded on two compressors. The glycol went from a test point of +14°C down to -4°C within 30 minutes for a total storage of 33000 litres.

Once at this temperature, any sign of heat load is matched and dealt with so easily it’s almost frightening. Outside of vintage the plant automatically runs at 25 – 50 percent load on one compressor and yet the hot water still comes flowing out. Power and water use are low.

At the end of the day, this system is efficient, deals with technology with ease and works well for the owners and winemakers at Sirromet. I’m very happy with the new plant and its outstanding features,” said Chapman.