New Seasons Market
7703 SW Nyberg Street
Tualatin, OR 97062

Refrigeration System Report
March 2017

Commissioning done by: N/A
Manufacturer:
Contractor:

Report published by:
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Executive Summary

The refrigeration system installed at the New Seasons Market located in Tualatin, Oregon was monitored by the ClimaCheck Analyzer beginning February 21, 2017 to March 16, 2017. The purpose of the measurement was to help the customer understand how the system is currently operating and understanding how much this system is using in kWh demand.

The date which was chosen to focus on was March 15th at 11:09 am. There is no specific reason for this time, other than it representative of a normal business day.

The total energy consumption for this plant is on average 600 kWh per day (MT compressors - 300 kWh, LT compressors is 200 – 240 kWh, Evap Tower 100-140 kWh).

The LT and MT systems do not have consistent stable operation. This is caused by the poor fan operation in the evaporative condenser. The condensing strategy of the condenser should be looked at as condensing temperature fluctuates 10-20F. There is a significant amount of savings that can be achieved by correcting this operation. For every 1F degree of reduction in condensing temperature will result into 1-2% lower energy consumption.

Further evaluation should be taken on the mechanical devices for each chiller and the subcooler for the LT rack. It is not 100% clear if these devices are working as designed or if there are upgrades needed to improve the efficiency of operation.
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Background

This report is based on the operation of both the LT and MT Racks located at the New Seasons Market located in Tualatin, Oregon. The report will outline current operation and any deficiencies identified from our monitoring.

1. System Design

Nyberg Rivers Medium Temperature refrigeration is provided by a multi-compressor system with a secondary glycol loop circulated thru all MT Cases. The low temperature refrigeration is provided by a standard multi-compressor DX rack with a sub cooler heat exchanger cooled by the MT rack. Each rack is independently controlled by an Emerson CPC controller.

<table>
<thead>
<tr>
<th>Medium Temperature Compressors</th>
<th>Low Temperature Compressors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copeland Discus 3D</td>
<td>3DSDS12ML-TFD-C41</td>
</tr>
<tr>
<td>Copeland Discus 4D</td>
<td>4DJNR28ML-TSK-C55</td>
</tr>
<tr>
<td>Copeland Discus 4D</td>
<td>4DRNRR28ML-TSK-C55</td>
</tr>
<tr>
<td>Copeland Discus 4D</td>
<td>4DJNRR28ML-TSK-C56</td>
</tr>
<tr>
<td>Copeland Discus 2D</td>
<td>2DL3F20KL-TFD-C41</td>
</tr>
<tr>
<td>Copeland Discus 3D</td>
<td>3DBOF33K1-TFD-C41</td>
</tr>
<tr>
<td>Copeland Discus 3D</td>
<td>3DF3F40KL-TFD-C41</td>
</tr>
</tbody>
</table>

As noted above, each rack has a digital unloader, while the MT has a secondary mechanical unloader on compressor three.

Both Racks use a water evaporative condenser.

1.1 System Layout

1.1.1 Medium Temperature Rack
1.1.2 Low Temperature Rack
2. Energy Consumption

2.1 Energy Consumption Medium Temp - Total

In the following graph, **Yellow line** shows ambient temperature, **red line** is energy signature at prevailing outdoor temperature. **Red bars** are measured energy consumption. Evaporation tower and medium temperature compressors are included in the MT total. At the beginning of the monitoring the system was using 400kWh on average. After March 7th the usage increased to 500kWh on average. Ambient temperature does contribute to this increase.

2.1.1 Energy Consumption Medium Temp Compressors

Energy consumption can be separated between compressors and condenser fans. The below graph shows the energy usage for the compressors. During this period it is shown that the compressors use the majority of the energy usage with an average daily usage of 300 kWh per day. The same increase of usage is shown from March 7th to the end of the monitoring period.
2.1.2 Energy Consumption of Evaporation Condenser

Energy consumption is between 100 – 140 kWh.
2.2 Energy Consumption – Low Temperature Compressors

Shown below, the Low Temperature compressors appear to consume the same amount of energy on a daily basis. Average use is between 200 – 240 kWh per day.

3. Unstable Fan Control

In the following graph it is shown the fan control and how unstable it is. It will be shown in the following sections how this fan control is creating an unstable operation in both systems. As shown in orange this unstable operation affects the whole system, and decreases its reliability.
4. Medium Temperature System

Below the Medium Temperature rack is in a constant stage of temperature and pressure changes. The system does not achieve a stable operation during the 24 hours outlined in the graph.
4.1 High Condenser Approach

There is a large difference between the condensing temperature of the MT system and the outdoor temperature, as shown below. The condensing temperature on the LT system behaves similarly. An increased condensing temperature as seen below significantly increases the power consumption of the system.
4.2 High Discharge Temperature on Compressor one.

Compressor 1 of the Medium Temperature system is a digitally controlled compressor. This compressor is showing higher than normal discharge temperatures. A digital discus compressor will have up to a 15-20F higher discharge at low load. This compressor is showing at times a 50F higher discharge indicating low efficiency. This, with the small changes in the total compressor’s power leads is likely caused by the running near minimum capacity for long periods of time which reduces the efficiency of the compressor and higher temperatures increase stress on compressor and oil. The controls should be looked at closer to see how compressor 3 is interacting with comp 1. Compressor 3 has a mechanical unloader and could be causing compressor 1 to run so hot. It should also be noted that the Compressor 3 discharge temperature is not decreasing as much as the others, when turned off.
5. Low Temperature System

The Low Temperature System shows the same behavior on the condenser side as the Medium Temperature Rack since this rack shares the same evaporative condenser. Below the Low Temperature rack is in a constant stage of temperature and pressure changes. The system does not achieve a stable operation during the 24 hours outlined in the this graph.
5.1 High Condenser Approach

As like the Medium Temperature Rack, the Low Temperature also has a very large difference between the condensing temperature of the Low Temperature system and the outdoor temperature, as shown below. Increasing the condensing temperature significantly increases the power consumption of the system.
5.1.1 High Pressure

In the below graph it is shown how unstable the High Pressure is. Pressure fluctuates as much as 40 psi on both the LT and MT racks.
5.1.2 Evaporation Temperature

Evaporation temperature on the LT rack fluctuates 10 – 15°F throughout the day. Fluctuations are affected by load but also unstable condensing.

6 Heat Reclaim

Heat reclaim is turned on with both systems.
- Medium Temperature – Approximately 10-15 F of Heat is extracted from the discharge
- Low Temperature - Approximately 100 – 110 F of Heat is extracted from the discharge
7 Suction Header of the Medium Temperature

Below it is shown the two suction lines coming from each chiller. **Chiller 1 is in light blue** and **Chiller 2 in light green**. Chiller 2 should be looked at as the temperatures from this chiller fluctuate quite a bit more than Chiller 1.

The Third temperature reading is the sub cool line coming from the Low Temperature side. It is not clear if the mechanical valves are working correctly. It is shown that the temperature stays constant for most of the day with periods of sudden drops in the temperature.