Reverse Cycle Chiller for Multifamily Pilot – Project Update

Pilot Study #1 Commissioning Report

22 April 2013

A Report of BPA’s Energy Efficiency’s Emerging Technologies Initiative

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Contract Number 35753
Introduction

This report documents commissioning activities for the Reverse Cycle Chiller system installed at the Stream Uptown multifamily project located at 708 6th Ave. N, Seattle, WA 98109. The Reverse Cycle Chiller (RCC) is setup to provide heat pump water heating for a central domestic hot water system for the 118 unit apartment project. The RCC functions as the primary garage exhaust system and domestic hot water (DHW) heat plant. The heat pump recovers heat from the below grade parking garage air prior to it being exhausted out of the garage. This report covers the details of the Commissioning (Cx) activities for the project.

Figure 1: RCC Garage Layout and Airflow Schematic

Figure 2 RCC Heat Plant Schematic
Equipment

The RCC heat plant consists of 2 reverse cycle chillers, 2 backup electric tanks and 8 hot water storage tanks and associated piping, valves, insulation, etc.

**RCC #1: Reverse Cycle Chiller 1**
- **Model:** Colmac HPA 15-PBGC
- **Serial Number:** 082012HPA15-118

**RCC #2: Reverse Cycle Chiller 2**
- **Model:** Colmac HPA 15-PBGC
- **Serial Number:** 082012HPA15-117

**WH #1: Backup Electric Water Heater 1**
- **Model:** Lochinvar HSP45080
- **Serial Number:** 1225M002558

**WH #2: Backup Electric Water Heater 2**
- **Model:** Lochinvar HSP45080
- **Serial Number:** 1225M002556

**HWS #1-8: Hot Water Storage Tanks (2@80 gal, 4@120 gal, 2@200 gal)**
- **Model:** J28-80A, J-28-120A, J-32-200A

Commissioning of Systems

**RCC-1&2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Setpoint</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation per contract documents (Y/N)</td>
<td>Yes</td>
<td>RCC's have been installed per contract documents and are performing in accordance with the final owner’s project requirements (OPR) document. RCC's are installed in the designated locations, bolted down for seismic bracing, include flexible connections for exhaust ducting, ductwork securely fastened to building structure, exhaust air terminates outside per local codes.</td>
</tr>
</tbody>
</table>
RCC Output Temperatures | 132-135 F | RCC's are setup to deliver fixed hot water temperature of approximately 133 deg F in a single pass arrangement. Each RCC has a 3-way modulating control valve that modulates water flow to maintain a single output temperature in one pass. We observed output temperatures between 132-135F with normal fluctuations associated with PID valve control.

| Aquastat Setpoints | On-117F Off-120F | RCC's include remote sensor and internal PLC board setup to fire RCC's when first tank drops below 117F and powers off when first tank reaches 120F.

| Exhaust Ducting | Yes (R-4) | Exhaust Ducting is internally insulated with 1” sound lining to reduce noise and prevent condensation on external ductwork.

**WH-1&2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Setpoint</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation per contract documents (Y/N)</td>
<td>Yes</td>
<td>Water Heaters have been installed per contract documents, heaters have been piped per contract documents, piping is adequately supported, seismic strapping is present, piping insulation, T&amp;P’s relief installed.</td>
</tr>
<tr>
<td>Water Heater Aquastat Setpoints</td>
<td>125 F</td>
<td>WH-1&amp;2 are setup to fire at 125F. Since the RCC is set to output 130 deg F water which routes through the electric tanks, these are only needed if the RCC fails to produce 130 deg F water.</td>
</tr>
</tbody>
</table>

**ST-1 to 8**

<table>
<thead>
<tr>
<th>Item</th>
<th>Setpoint</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation per contract documents (Y/N)</td>
<td>Yes</td>
<td>Storage tanks have been installed per contract documents, heaters have been piped per contract documents, piping is adequately supported, seismic strapping is present, piping insulation is present, T&amp;P’s reliefs installed.</td>
</tr>
<tr>
<td>Setpoints</td>
<td>On-117F Off-120F</td>
<td>Storage tank setpoints are set by RCC-1 and 2 aquastat sensors controlled from PLC.</td>
</tr>
</tbody>
</table>

**Misc:**

<table>
<thead>
<tr>
<th>Detail</th>
<th>Setpoint</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piping Insulation</td>
<td>Yes</td>
<td>Piping is insulated per WSEC, 1-1/2” fiberglass insulation. Cold water is heat traced for freeze protection</td>
</tr>
<tr>
<td>Recirculation Pumps</td>
<td>On</td>
<td>2 Hot water recirculation legs are installed in this project, both of the recirculation pumps (B&amp;G Series 100) are installed and operating per specs</td>
</tr>
<tr>
<td>Thermostatic Mixing Valves</td>
<td>123 F</td>
<td>Two 2” thermostatic mixing valves are installed and set to deliver 123 F water to distribution loop. Water at the top floor was measured at 119F supply with adequate pressure.</td>
</tr>
</tbody>
</table>
## Commissioning Log

### Acronyms:
- NKA - NK Architects, PC - Plumbing Contractor (JJ's Plumbing), MC - Mechanical Contractor (GB Systems), B1 - Owner (Brook 1), GC - General Contractor (Compass)

Note that Issues Log excerpted below includes only the items related to the RCC system.

<table>
<thead>
<tr>
<th>Issue #</th>
<th>Date Noted</th>
<th>System</th>
<th>Issues</th>
<th>Assigned to</th>
<th>Corrective Action</th>
<th>Response / Completed / Verified Date</th>
<th>Notes</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>12/4/12</td>
<td>RCC Garage Exhaust</td>
<td>Backdraft dampers are missing on all 3 garage exhaust ducts to outdoors. Noticed some exhaust air short cycling back into garage. Install backdraft dampers on all exhaust air streams.</td>
<td>MC/GC</td>
<td>Install backdraft dampers</td>
<td>MC-2/20/2013</td>
<td>Backdraft dampers installed</td>
<td>Closed</td>
</tr>
<tr>
<td>37</td>
<td>12/4/12</td>
<td>RCC Garage Exhaust</td>
<td>Seal all garage exhaust ducts, noticed some air leakage back into garage.</td>
<td>MC/GC</td>
<td>Ducting should be sealed airtight.</td>
<td>MC-2/20/2013</td>
<td>Ducting has been sealed</td>
<td>Closed</td>
</tr>
<tr>
<td>38</td>
<td>12/4/12</td>
<td>Piping Insulation</td>
<td>Hot water piping in garage still has pieces that are exposed, insulate all hot water piping.</td>
<td>PC/GC</td>
<td>Insulate all exposed piping around unions and elbows and tank connections</td>
<td>GC-3/5/2013</td>
<td>Piping is insulated</td>
<td>Closed</td>
</tr>
<tr>
<td>39</td>
<td>12/17/12</td>
<td>RCC Filters</td>
<td>There is considerable construction debris in the RCC intake air filters. These filters are washable and should be cleaned or replaced prior to close-out.</td>
<td>GC</td>
<td>Clean or replace RCC intake air filter.</td>
<td>MC-3/5/2013</td>
<td>Filters have been cleaned</td>
<td>Closed</td>
</tr>
<tr>
<td>40</td>
<td>12/17/12</td>
<td>Thermostatic Mixing Valves</td>
<td>Hot water delivered to apartments should be set to 123 deg F. Current settings are 118F for the West and 125F for the East mixing station.</td>
<td>GC</td>
<td>Plumber to set mixing valves to 123F.</td>
<td>PC-1/17/2013</td>
<td>Setpoints adjusted and confirmed</td>
<td>Closed</td>
</tr>
<tr>
<td>41</td>
<td>12/18/12</td>
<td>Signage</td>
<td>Specifications called for alarm signage stating that tenants should call building owner or leasing manager if RCC is in an alarm state.</td>
<td>GC</td>
<td>Signage has been posted on surrounding fence.</td>
<td>GC-3/4/2012</td>
<td>Signage has been installed</td>
<td>Closed</td>
</tr>
</tbody>
</table>
Photos

**Photo 1: RCC’s Looking West**

![RCC’s Looking West](image1)

**Photo 2: RCC’s Installation Looking North**

![RCC’s Installation Looking North](image2)
Photo 3 & 4: RCC Discharge Location and RCC Piping Connection

Photo 5: Hot Water Storage Tank Skid
Photo 6: RCC Controls/Pumping Internals

Photo 7: RCC Intake Air Filter
Photo 8: RCC Evaporator Fan and Coil

Photo 9: Hot Water Storage Tanks Serial Tanks
Photo 10: RCC Serial Numbers

Photo 11: Electric Water Heater Serial Numbers