Application of Oil Flooded Compression with Regeneration to a Packaged Heat Pump System

RAs: Bin YANG, Timothy BLATCHLEY, Christian BACH

PIs: Jim E. BRAUN, Travis HORTON, Eckhard GROLL
Outline

- Introduction
- Experiment
- Results and Discussion
- Conclusions
Introduction

Figure 1: Energy consumption in residential sectors in U.S. (http://www.eia.gov/consumption/residential/index.cfm)

Figure 2: System performance of the air source heat pump at different ambient temperatures (Ramaraj, 2012)
Introduction

Figure 4: Schematic of the typical heat pump system using oil flooded compression with regeneration technology

(Bell, 2011)
Introduction

<table>
<thead>
<tr>
<th>Study</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Hugenroth et al. (2006)</td>
<td>Studied on the effect of liquid flooding in the Ericsson cycle; Experimentally investigated the oil flooding effect on a heat pump system performance.</td>
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<tr>
<td>Bell et al. (2011, 2012)</td>
<td>Developed a detailed scroll compressor model with oil flooded technology; Investigated the effect of oil flooded compression technology combined with regeneration on an air source heat pump.</td>
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</table>
Experiment

Figure 4: Schematic of the packaged heat pump system using oil flooded compression with regeneration technology
Experiment

Figure 5: Experimental setup

(a) Overview

(b) Oil flooded compressor prototype
# Table 2: Test matrix for oil flooded system

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Indoor Unit [°F</th>
<th>Outdoor Unit [°F</th>
<th>Indoor Air Flow rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EDB</td>
<td>EWB</td>
<td>EDB</td>
</tr>
<tr>
<td>H1</td>
<td>70</td>
<td>&lt;=60</td>
<td>47</td>
</tr>
<tr>
<td>H2</td>
<td>70</td>
<td>&lt;=60</td>
<td>17</td>
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<tr>
<td>H3*</td>
<td>0</td>
<td>minimum</td>
<td>0</td>
</tr>
</tbody>
</table>
Results and Discussion

Figure 6: COP improvement for oil flooded system combined with regeneration technology

Figure 7: Heating capacity improvement for oil flooded system combined with regeneration technology
Results and Discussion

Figure 8: Heating seasonal efficiency and COP improvement of oil flooded system

Figure 9: Heating load and heat capacity for different ambient temperatures
Results and Discussion

Figure 10: Oil flooded system COP at different ambient temperatures for application 1 and 2
Conclusions

- The tested prototype system demonstrates promising application of the oil flooded compression combined with regeneration technology into the low ambient heat pump;

- One circuit of the indoor coil was used as the oil cooler, leading to a smaller condenser heating transfer area and potential maldistribution inside the indoor coil;

- A new oil flooded system using a new prototype compressor and oil cooler will be tested soon at Herrick Labs.