# Appendix

This appendix describes the methods and analytical procedures used in this study, including the testing equipment and facility, refrigerant characterization, performance calculation, and uncertainty analysis. It also describes the testing results of additional tests for which the results were not covered in the main body of the study.

## Test Equipment and Facility

All testing was conducted between August and December 2025 by OTS R&D, Inc., an independent research laboratory based in Beltsville, Maryland, using its environmental chamber and conditioned wind tunnel facilities.

### *Testing equipment*

To ground the analysis in real-world practice, two heat pump systems were evaluated to reflect the most common sizes and configurations found in US residential and light-commercial buildings. The first was a 3-ton residential split-system heat pump, representative of typical single-family HVAC installations. The second was a 5-ton packaged rooftop unit (RTU), commonly used in commercial buildings. Both systems were equipped with fixed-speed scroll compressors and thermostatic expansion valves (TXVs)[1], mirroring the dominant technology currently deployed across much of the market.

The split system indoor unit was installed in a closed-loop conditioned wind tunnel to control inlet air temperature, humidity, and airflow rate, while the outdoor unit was located in an environmental chamber. The RTU was installed within an environmental chamber with ducted air-side instrumentation.

*Exhibit A1: Summary of test equipment specifications*

| | 3-ton split system | 5-ton packaged system |
|---|---|---|
| Brand | Arcoaire* | Fujitsu* |
| Model | ODU: R4H5S36AKAAAABAG | RQPM-A060JK000 |

[1] The split system operated with a TXV in cooling mode and a fixed orifice expansion device in heating mode

| | IDU: FJMA4X36L0BB | |
|---|---|---|
| AHRI Reference | 210999017 | 201851520 |
| Cooling Capacity[1] [kW] | 10.02 | 16.71 |
| SEER [BTU/W-h] | 14.3 (SEER2) | 14 (SEER) |
| EER[1] [BTU/W-h] | 12.00 (EER2) | 11.00 (EER) |
| Cooling Power Consumption[1] [kW] | 2.85 | 5.17 |
| Heating Capacity[2] [kW] | 9.96 | 17.00 |
| HSPF (region IV) [BTU/W-h] | 7.5 (HSPF2) | 8 (HSPF) |
| Heating COP[2] [-] | 3.76 | 2.54 |
| Heating Power Consumption[2] [kW] | 2.68 | 4.74 |
| Factory Charge [oz] | 144 | 193 |
| Compressor Type | Fixed-speed scroll | Fixed-speed scroll |

1. 35°C/95°F Outdoor air temperature
2. 8.3°C/47°F Outdoor air temperature

*Exhibit A2: schematic of split system experimental set up*

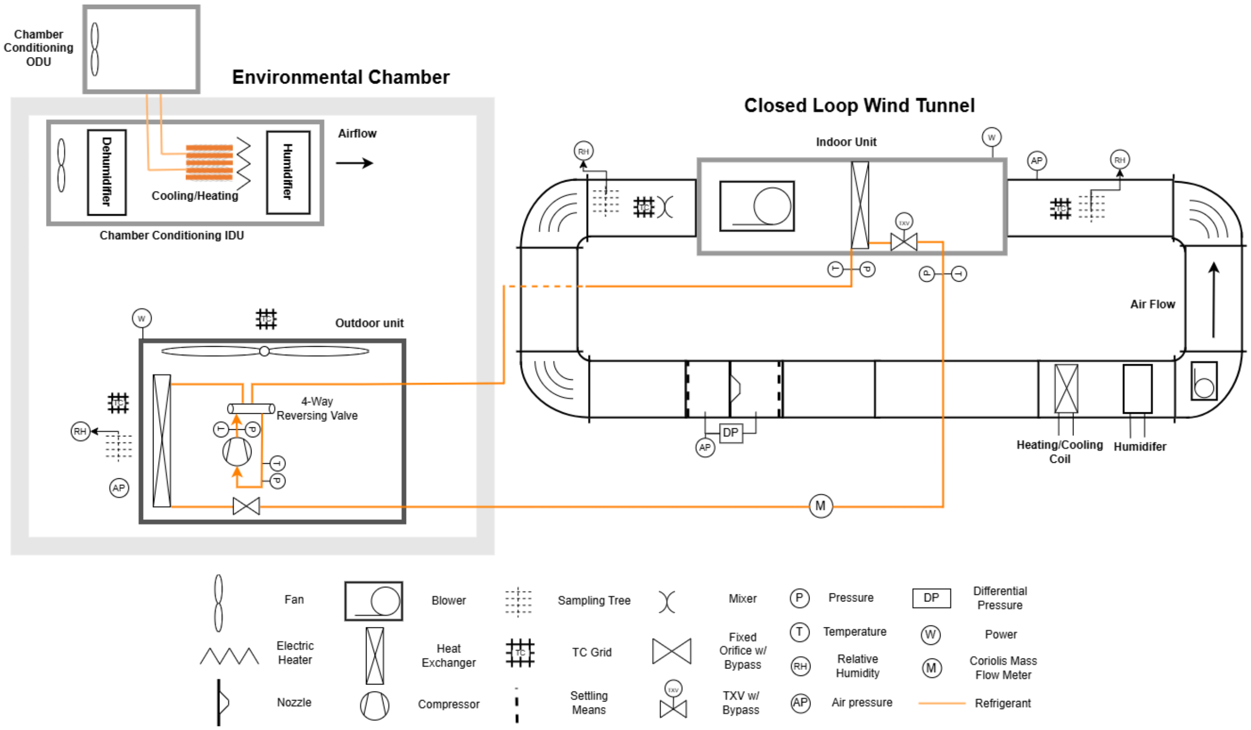
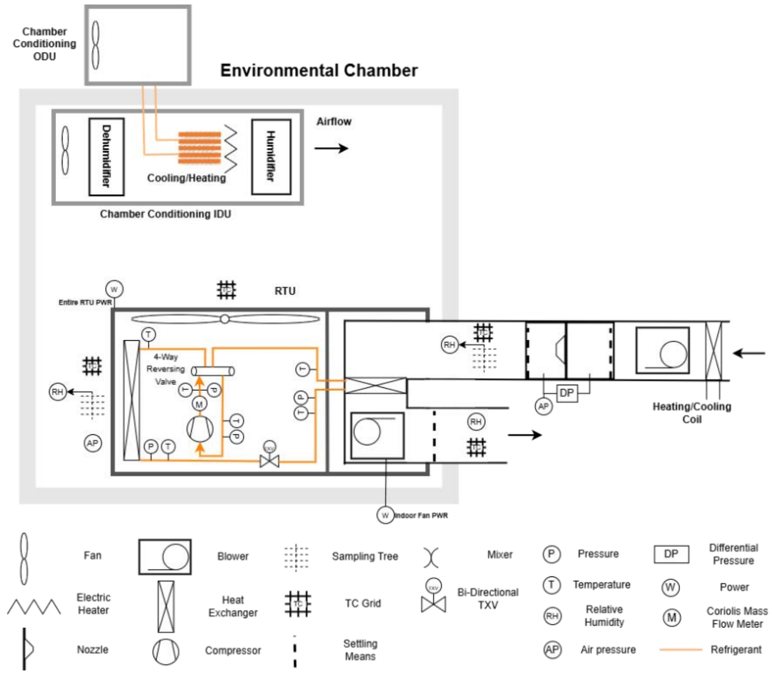


*Figure A 3: Schematic of RTU experimental set up*




## Refrigerant Samples

Refrigerant conditions were evaluated to reflect realistic supply scenarios encountered in the field:

- (1) virgin R-410A purchased directly from a manufacturer and
- (2) reclaimed R-410A prepared to represent a conservative "worst-case" composition while still meeting AHRI 700 purity standards.
- (3) recovered R-410A: A recovered refrigerant sample was tested to represent a higher-impurity, field-recovered condition that had not undergone reclamation to AHRI 700 standards.

The virgin refrigerant was sourced from Hudson/Arkema and independently analyzed to confirm compliance with AHRI 700 purity requirements. The reclaimed sample (also sourced from Hudson) was intentionally formulated at the maximum allowable limits under AHRI 700, including the maximum permitted concentration of R-32 and the maximum allowable non-condensable gas content, both of which would be expected to increase discharge pressure relative to a pure fluid. Additionally, 0.5% R22 was added as the maximum allowable amount of "other volatiles".

While not the focus of the main body of the study, a recovered refrigerant sample was also evaluated to represent a higher-impurity, field-recovered condition that had not undergone reclamation or "recycled." Inclusion of this sample allowed assessment of whether elevated non-condensable gas (NCG) concentrations could measurably affect short-term system performance.

The composition of the samples for each of the refrigerants was evaluated using gas chromatography (GC) and are reported in the table below. To validate consistency between the samples in the cylinders and what entered the tested systems, refrigerant samples used in the RTU test were removed and measured as well.

*Exhibit A4: Sample compositions of refrigerants used in testing*

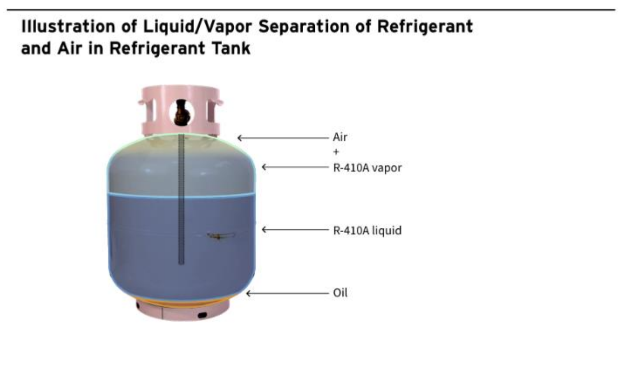
| | | **AHRI 700 Req.** | **Virgin Cyl. 1** | **Virgin Cyl. 2** | ***Certified Reclaimed**** | **"Worst-Case" Reclaimed** | **Recovered** |
|---|---|---|---|---|---|---|---|
| Purity | % | >99.5% | 99.99% | 99.91% | 99.61% | 99.5% | 99.76% |
| Composition | % wt. R32 / R125 | 48.5-50.5 / 49.5-51.5 | 49.77/ 50.23 | 49.62/ 50.38 | 49.92 /50.08 | 50.34 / 49.66 | 50.49/ 49.51 |
| Air and non-condensable gases | %v/v @ 25°C | <1.5% | 0.67% | 1.37% | 0.36% | 1.46% | 5.96% |
| Other volatiles | % wt. | <0.5% | 0.01% | 0.09% | 0.39% | 0.5% (R22) | 0.24% |

*Not tested in systems but included to show that actual reclaimed refrigerant is typically better quality than the "worst-case" sample prepared for this project.

## Impacts of Charging Procedure and NCG

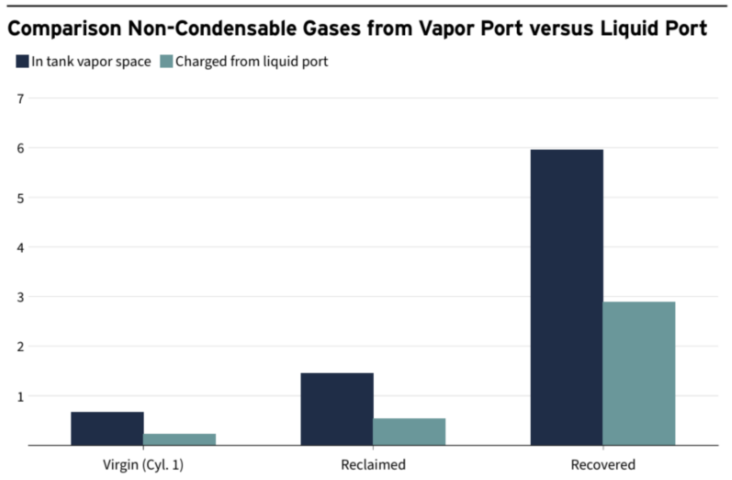
One of the primary contaminants that are expected to impact short-term system performance is non-condensable gas (NCG) concentrations, such as air. Under AHRI 700, NCG concentration is measured in the vapor space above the liquid refrigerant at 25°C, and maximum NCG concentrations are specified based on vapor-space measurement. However, refrigerant cylinders will contain refrigerant separated into both liquid and vapor phases; NCGs preferentially reside in the vapor space, but the amount of NCGs that may reside in either portion can vary based on temperature and charging practice. Cylinders have two ports to preferentially access either the vapor or liquid space. While technician standard practice is to charge refrigerants from the liquid port of the refrigerant tank (or from the vapor port of an inverted tank), vapor measurements of NCGs values do not necessarily reflect the concentration entering the system when refrigerant is charged from the liquid port.

*Exhibit A5: Illustration of liquid/vapor separation of refrigerant and air in refrigerant tank*




Systems in this study were charged from the liquid port (in accordance with standard field practice) after the cylinders were left to equilibrate. GC samples collected during charging showed that liquid-phase NCG concentrations were approximately 35–50% lower than the corresponding vapor-space measurements (Figure below). This may change as refrigerant in a cylinder is depleted. Therefore, a limited set of additional system performance tests were conducted by charging the RTU system using a nearly depleted refrigerant cylinder. This is to mimic a field scenario in which a technician may be charging with a nearly empty cylinder where as much of the NCG in the tank would enter the system as possible. These results are reflected in the tabular results at the bottom of the appendix.

*Exhibit A6: Comparison of non-condensable gases from vapor port versus liquid port*




## Test Protocols and Measurements

Testing was conducted in accordance with AHRI Standard 210/240 for performance rating of unitary air-conditioning and air-source heat pump equipment. Measurement practices and instrumentation all complied with ASHRAE 37 and ASHRAE 41 standards. System performance was assessed under four AHRI rating conditions: $A_{full}$ and $B_{full}$ (cooling), and H1 and H2 (heating). Indoor airflow rates were held constant for each system throughout testing.

### *Refrigerant charge amounts*

The appropriate refrigerant charge for each system was established by charging the manufacture specified nameplate amount of virgin refrigerant, and then adjusted until 7K of subcooling was achieved under $A_{full}$ conditions. The resulting final charge masses were 10.00±0.03 lb for the split system and 12.99±0.03 lb for the RTU. This charge was held constant across refrigerant conditions to ensure direct comparability, with the exception of a limited set of undercharged system tests. A few tests were conducted to determine how low charge affects the performance of the RTU to mimic field conditions where refrigerant was not appropriately charged or systems were running having leaked some refrigerant. For these tests, the RTU was charged with liquid refrigerant to 85%, 70%, and 55% of the full RTU charge.

### *Measurement process*

Steady-state data was recorded at one-second intervals for a minimum of 30 minutes once operating conditions stabilized within AHRI tolerances. For H2 heating tests, where frost accumulation introduces transient behavior, performance was evaluated over a complete defrost interval (i.e., end of defrost to the end of defrost).

### *Performance calculations*

Performance was calculated primarily using refrigerant-side capacity derived from measured refrigerant mass flow rate and enthalpy difference across the heat exchanger. Refrigerant thermodynamic properties were determined from measured temperature and pressure using XProps® thermophysical property software. Refrigerant-side capacity was used as the primary performance metric due to its lower measurement uncertainty.

Air-side capacity was also calculated using measured airflow rate and inlet/outlet air conditions. In operating conditions where subcooling was not present — such as certain H2 heating tests and reduced-charge scenarios — air-side capacity was used instead. Energy balance between refrigerant-side and air-side capacity was required to remain within 5% under steady-state conditions.

System efficiency was evaluated as coefficient of performance (COP) in heating mode and energy efficiency ratio (EER) in cooling mode, calculated from measured thermal capacity and electrical power input.

### *Measurement uncertainty*

Measurement uncertainty incorporated both systematic error (based on manufacturer-stated instrument accuracy) and random error (based on steady-state variation in measured values). Measurement uncertainties were calculated using published manufacturer accuracy specifications and combined using standard uncertainty propagation methods. Uncertainty for calculated quantities, including capacity and efficiency, was determined using standard propagation methods consistent with ASHRAE Standard 37. This methodology was applied consistently across both the 3-ton split system and the 5-ton RTU.

Repeat testing was conducted to assess experimental variability. For the split system, average replicate deviation under identical operating conditions was approximately 0.4%, with a maximum observed deviation of approximately 2.5%. These values were comparable in magnitude to the propagated measurement of uncertainty for key performance metrics. RTU results were evaluated using the same uncertainty framework and showed variation within similar uncertainty bounds.

## Test Results

### *Discussion of results*

Observed differences between system performance for the different refrigerant sample across the refrigerant conditions were evaluated relative to the combined measurement uncertainty and repeatability thresholds described in the above section. Differences smaller than this range were not considered statistically meaningful.

When charged using normal procedures (from liquid port), across all steady-state conditions for both systems, measured differences in capacity, efficiency (COP/EER), discharge pressure, and power consumption between virgin and reclaimed refrigerant were within calculated measurement uncertainty bounds. Under H2 heating conditions, larger uncertainty was observed but maximum variation in any of the metrics measured did not exceed uncertainty limits, so it is not considered statistically significant.

The recovered refrigerant sample performed similarly to the virgin and reclaimed refrigerant samples in these conditions. However, it is important to note that field-recovered refrigerant quality is inherently variable, as it is not certified to AHRI 700 or a similar standard, so the results observed here should not be interpreted as universally replicable across all recovered refrigerant samples. Also, recovered refrigerant can contain contaminants such as acids and moisture that may not affect short term performance measured in this study, but could impact longer term reliability of components that need to be considered independently.

In near-empty tank testing designed to introduce elevated NCG concentrations, the RTU saw no small meaningful changes in capacity or efficiency. A slight increase in discharge pressure (approximately 0.7%–2%) was observed, which was beyond measurement uncertainty. The magnitude of this increase is small and falls within the range of typical operating variability for such systems; no measurable impact on COP or capacity was detected, indicating that the increase in discharge pressure is not operationally significant. These results further validate that even under charging conditions that may result in higher NCGs in field installed systems, systems charged with cylinders within AHRI 700 NCG bounds will not significantly be affected.

In the tests of systems with lowered-charge, RTU performance remained largely stable down to approximately 85% of nominal charge, with capacity decreasing by roughly 4% and efficiency changing by approximately ±2%. Below 85% charge, performance degradation became more pronounced. These trends were consistent across refrigerant types. The resilience to performance loss at 85% charge can in part be explained by the presence of the TXV, which is able to dynamically meter the amount of refrigerant entering the evaporator and functionally acts as a buffer for the system to be impacted by low charge. These results are consistent with other literature on system performance with low charge; while there is some performance buffer built into these systems, leakage prevention and maintenance remain key to maintaining efficiency.

Overall, the results demonstrate no measurable short-term performance penalty associated with the use of reclaimed refrigerant meeting AHRI 700 purity standards. A summary of the full test results for both the split system and RTU can be found below.

### *Tabular results*

## *Split System*

### *Exhibit A7: Tabular summary of split system test results*

| Condition | Refrigerant | Refrigerant Charge [lbs] | Air-Side Capacity [W] | Ref-Side Capacity [W] | ODU Power [W] | IDU Power [W] | Subcooling [K] | COP [-] | EER [BTU/W-h] | Suction Pressure [kPa] | Discharge Pressure [kPa] | Superheat (Cooling Mode) [K] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_{full}$ | Virgin | 10.0 ± .03 | 10034 ± 560 | 9699 ± 60 | 2422 ± 9 | 299 ± 11 | 7.05 ± 0.45 | - | 12.16 ± 0.10 | 980 ± 1.8 | 2600 ± 14 | 5.55 ± 0.40 |
| | Reclaimed | 10.0 ± .03 | 9985 ± 584 | 9601 ± 59 | 2426 ± 9 | 292 ± 14 | 7.25 ± 0.42 | - | 12.05 ± 0.10 | 975 ± 1.7 | 2606 ± 13 | 5.46 ± 0.44 |
| $B_{full}$ | Virgin | 10.0 ± .03 | 10528 ± 831 | 10216 ± 83 | 2084 ± 10 | 301 ± 15 | 6.57 ± 0.63 | - | 14.61 ± 0.16 | 950 ± 2.7 | 2196 ± 21 | 6.31 ± 0.58 |
| | Reclaimed | 10.0 ± .03 | 10680 ± 804 | 10259 ± 85 | 2088 ± 13 | 290 ± 25 | 6.78 ± 0.63 | - | 14.72 ± 0.21 | 956 ± 2.6 | 2202 ± 22 | 5.87 ± 0.54 |
| H1 | Virgin | 10.0 ± .03 | 10230 ± 158 | 10436 ± 55 | 2444 ± 7 | 296 ± 13 | 8.68 ± 0.39 | 3.81 ± 0.03 | - | 842 ± 1.6 | 2566 ± 15 | - |
| | Reclaimed | 10.0 ± .03 | 10186 ± 153 | 10381 ± 57 | 2426 ± 8 | 289 ± 13 | 9.18 ± 0.38 | 3.82 ± 0.03 | - | 840 ± 1.8 | 2564 ± 15 | - |
| H2 | Virgin | 10.0 ± .03 | 7326 ± 375 | - | 2172 ± 15 | 300 ± 35 | - | 2.96 ± 0.18 | - | 680 ± 9.9 | 2261 ± 25 | - |
| | Reclaimed | 10.0 ± .03 | 7635 ± 291 | - | 2207 ± 10 | 294 ± 17 | - | 3.05 ± 0.13 | - | 704 ± 2.8 | 2308 ± 20 | - |

### *Exhibit A8: Tabular summary of split system recovered refrigerant test results*

| Condition | Refrigerant | Refrigerant Charge [lbs] | Air-Side Capacity [W] | Ref-Side Capacity [W] | ODU Power [W] | IDU Power [W] | Subcooling [K] | COP [-] | EER [BTU/W-h] | Suction Pressure [kPa] | Discharge Pressure [kPa] | Superheat (Cooling Mode) [K] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_{full}$ | Recovered | 10.0 ± .03 | 10013 ± 463 | 9578 ± 48 | 2422 ± 7 | 297 ± 9 | 6.90 ± 0.35 | - | 12.02 ± 0.08 | 980 ± 1.5 | 2597 ± 9 | 5.29 ± 0.36 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $B_{full}$ | Recovered | 10.0 ± .03 | 10704 ± 611 | 10239 ± 60 | 2090 ± 8 | 298 ± 13 | 6.64 ± 0.45 | - | 14.63 ± 0.12 | 957 ± 1.9 | 2200 ± 14 | 5.97 ± 0.42 | |
| H1 | Recovered | 10.0 ± .03 | 10167 ± 152 | 10434 ± 54 | 2451 ± 8 | 293 ± 13 | 10.03 ± 0.37 | 3.80 ± 0.03 | - | 842 ± 1.6 | 2596 ± 19 | - | |
| H2 | Recovered | 10.0 ± .03 | 7557 ± 273 | - | 2210 ± 11 | 298 ± 13 | - | 3.01 ± 0.12 | - | 705 ± 2.4 | 2316 ± 23 | - | |

## *RTU*

*Exhibit A9: Tabular summary of RTU test tesults*

| Condition | Refrigerant | Refrigerant Charge [lbs] | Air-Side Capacity [W] | Ref-Side Capacity [W] | Total Unit Power [W] | Subcooling [K] | COP [-] | EER [BTU/W-h] | Discharge Pressure [kPa] | Suction Pressure [kPa] | Superheat (Cooling Mode) [K] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_{full}$ | Virgin | 12.99 ± 0.03 | 17973 ± 1145 | 17515 ± 196 | 6642 ± 33 | 6.97 ± 0.6 | | 9.00 ± 0.11 | 2930 ± 16.0 | 1106 ± 1.8 | 3.17 ± 0.6 |
| | Reclaimed | 12.99 ± 0.03 | 17982 ± 1218 | 17425 ± 188 | 6623 ± 27 | 6.94 ± 0.6 | | 8.98 ± 0.10 | 2924 ± 11.4 | 1107 ± 1.8 | 3.38 ± 0.5 |
| $B_{full}$ | Virgin | 12.99 ± 0.03 | 19712 ± 1242 | 18791 ± 207 | 5961 ± 23 | 7.32 ± 0.7 | | 10.76 ± 0.13 | 2508 ± 10.2 | 1085 ± 1.8 | 3.40 ± 0.5 |
| | Reclaimed | 12.99 ± 0.03 | 19603 ± 1164 | 18702 ± 208 | 5927 ± 30 | 7.30 ± 0.7 | | 10.77 ± 0.13 | 2504 ± 12.8 | 1087 ± 1.9 | 3.73 ± 0.5 |
| H1 | Virgin | 12.99 ± 0.03 | 17816 ± 310 | 17764 ± 151 | 6156 ± 22 | 16.21 ± 0.5 | 2.89 ± 0.03 | | 2579 ± 7.1 | 805 ± 2.0 | |
| | Reclaimed | 12.99 ± 0.03 | 17726 ± 313 | 17630 ± 152 | 6127 ± 23 | 15.99 ± 0.5 | 2.88 ± 0.03 | | 2566 ± 7.0 | 802 ± 2.1 | |
| H2 | Virgin | 12.99 ± 0.03 | 11919 ± 415 | | 5700 ± 39 | | 1.97 ± 0.07 | | 2343 ± 18.6 | 649 ± 4.3 | |
| | Reclaimed | 12.99 ± 0.03 | 11828 ± 438 | | 5673 ± 37 | | 1.98 ± 0.08 | | 2331 ± 17.4 | 647 ± 4.6 | |

*Exhibit A10: Tabular summary of RTU recovered refrigerant test results*

| Condition | Refrigerant | Refrigerant Charge [lbs] | Air-Side Capacity [W] | Ref-Side Capacity [W] | Total Unit Power [W] | Subcooling [K] | COP [-] | EER [BTU/W-h] | Discharge Pressure [kPa] | Suction Pressure [kPa] | Superheat (Cooling Mode) [K] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_{full}$ | Recovered | 12.99 ± 0.03 | 17688 ± 1156 | 17262 ± 178 | 6605 ± 31 | 6.39 ± 0.6 | | 8.92 ± 0.10 | 2925 ± 8.8 | 1113 ± 1.7 | 3.54 ± 0.5 |
| $B_{full}$ | Recovered | 12.99 ± 0.03 | 19511 ± 1129 | 18632 ± 197 | 5915 ± 26 | 6.72 ± 0.7 | | 10.75 ± 0.12 | 2506 ± 9.9 | 1094 ± 1.6 | 4.24 ± 0.5 |
| H1 | Recovered | 12.99 ± 0.03 | 17875 ± 301 | 17592 ± 149 | 6074 ± 21 | 15.18 ± 0.5 | 2.90 ± 0.03 | | 2549 ± 5.1 | 804 ± 2.1 | |
| H2 | Recovered | 12.99 ± 0.03 | 11696 ± 428 | | 5617 ± 38 | | 1.96 ± 0.08 | | 2312 ± 18.7 | 647 ± 5.3 | |

*Exhibit A11: Tabular summary of RTU test results — near empty tank*

| Condition | Refrigerant | Refrigerant Charge [lbs] | Air-Side Capacity [W] | Ref-Side Capacity [W] | Total Unit Power [W] | Subcooling [K] | COP [-] | EER [BTU/W-h] | Discharge Pressure [kPa] | Suction Pressure [kPa] | Superheat (Cooling Mode) [K] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_{full}$ | Reclaimed | 13.03 ± .05 | 18056 ± 1626 | 17395 ± 269 | 6660 ± 42 | 7.70 ± 1.02 | | 8.91 ± 0.15 | 2951 ± 12 | 1110 ± 2.5 | 7.70 ± 1.02 |
| | Recovered | 13.02 ± .05 | 17993 ± 1739 | 17415 ± 261 | 6726 ± 32 | 7.19 ± 0.90 | | 8.83 ± 0.14 | 2967 ± 11 | 1122 ± 2.8 | 7.19 ± 0.90 |
| $B_{full}$ | Reclaimed | 13.03 ± .05 | 19564 ± 1633 | 18714 ± 279 | 5970 ± 39 | 7.98 ± 1.08 | | 10.70 ± 0.17 | 2528 ± 10 | 1092 ± 2.4 | 7.98 ± 1.08 |
| | Recovered | 13.02 ± .05 | 19635 ± 1717 | 18802 ± 295 | 6042 ± 35 | 7.66 ± 1.12 | | 10.62 ± 0.18 | 2552 ± 16 | 1107 ± 2.3 | 7.66 ± 1.12 |
| H1 | Reclaimed | 13.03 ± .05 | 17962 ± 328 | 17641 ± 147 | 6166 ± 27 | 16.88 ± 0.52 | 2.86 ± 0.03 | | 2598 ± 7 | 805 ± 1.8 | 16.88 ± 0.52 |
| | Recovered | 13.02 ± .05 | 17935 ± 308 | 17670 ± 145 | 6200 ± 20 | 16.56 ± 0.50 | 2.85 ± 0.03 | | 2603 ± 6 | 807 ± 1.9 | 16.56 ± 0.50 |

## *Exhibit A12: Tabular summary of RTU test results — low charge*

| Condition | Refrigerant | Charge level [%] | Refrigerant Charge [lbs] | Air-Side Capacity [W] | Ref-Side Capacity [W] | Unit Power [W] | Subcooling [K] | COP [-] | EER [BTU/W-h] | Discharge Pressure [kPa] | Suction Pressure [kPa] | Superheat (Cooling Mode) [K] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_{full}$ | Virgin | 85% | 11.01 ± .03 | 17203 ± 1802 | 16775 ± 278 | 6444 ± 40 | 0.90 ± 1.10 | | 8.88 ± 0.16 | 2816 ± 11 | 1120 ± 3 | 4.33 ± 0.64 |
| | Reclaimed | 85% | 11.05 ± .03 | 17235 ± 1751 | 16684 ± 272 | 6455 ± 31 | 0.93 ± 0.93 | | 8.82 ± 0.15 | 2819 ± 12 | 1119 ± 3 | 3.84 ± 0.65 |
| | Recovered | 85% | 11.06 ± .03 | 16928 ± 1708 | 16683 ± 294 | 6461 ± 41 | 0.94 ± 1.09 | | 8.81 ± 0.17 | 2821 ± 20 | 1122 ± 3 | 4.11 ± 0.77 |
| $B_{full}$ | Virgin | 85% | 11.01 ± .03 | 18813 ± 1710 | 18214 ± 323 | 5796 ± 49 | 1.28 ± 1.21 | | 10.72 ± 0.21 | 2414 ± 25 | 1101 ± 3 | 5.31 ± 0.91 |
| | Reclaimed | 85% | 11.05 ± .03 | 18877 ± 1704 | 18066 ± 349 | 5826 ± 54 | 1.26 ± 1.30 | | 10.58 ± 0.23 | 2420 ± 30 | 1102 ± 3 | 4.55 ± 1.01 |
| | Recovered | 85% | 11.06 ± .03 | 18881 ± 1604 | 18086 ± 299 | 5821 ± 32 | 1.33 ± 1.05 | | 10.60 ± 0.18 | 2420 ± 15 | 1103 ± 2 | 4.98 ± 0.72 |
| H1 | Virgin | 85% | 11.01 ± .03 | 17118 ± 302 | 17057 ± 153 | 5790 ± 23 | 8.16 ± 0.56 | 2.95 ± 0.03 | | 2378 ± 5 | 806 ± 2 | |
| | Reclaimed | 85% | 11.05 ± .03 | 17251 ± 303 | 16872 ± 145 | 5841 ± 19 | 7.79 ± 0.56 | 2.89 ± 0.03 | | 2386 ± 6 | 803 ± 2 | |
| | Recovered | 85% | 11.06 ± .03 | 17310 ± 301 | 16987 ± 143 | 5801 ± 20 | 7.90 ± 0.52 | 2.93 ± 0.03 | | 2374 ± 5 | 804 ± 2 | |
| H2 | Virgin | 85% | 11.01 ± .03 | 11654 ± 396 | | 5447 ± 31 | | 2.02 ± 0.07 | | 2207 ± 11 | 662 ± 3 | |
| | Reclaimed | 85% | 11.05 ± .03 | 11551 ± 449 | | 5432 ± 35 | | 2.00 ± 0.08 | | 2145 ± 15 | 651 ± 8 | |
| | Recovered | 85% | 11.06 ± .03 | 11565 ± 429 | | 5395 ± 30 | | 2.03 ± 0.08 | | 2168 ± 14 | 656 ± 6 | |
| $A_{full}$ | Virgin | 70% | 9.08 ± .03 | 14900 ± 1653 | | 6242 ± 48 | | | 8.10 ± 0.91 | 2674 ± 22 | 1003 ± 3 | 18.59 ± 0.82 |
| H1 | | 70% | 9.08 ± .03 | 15928 ± 474 | | 5562 ± 26 | | 2.87 ± 0.09 | | 2225 ± 8 | 802 ± 3 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **$A_{full}$** | | 55% | 7.27 ± .03 | 11945 ± 1649 | | 5990 ± 28 | | | 6.80 ± 0.94 | 2525 ± 11 | 842 ± 2 | 26.11 ± 0.63 |
| **H1** | | 55% | 7.27 ± .03 | 14118 ± 406 | | 5348 ± 23 | | 2.62 ± 0.08 | | 2102 ± 6 | 747 ± 3 | |