SUMMARY OF TEST REPORT

Heat Recovery performance testing on high S.E.E.R. Air Conditioning

Testing was performed on September 11, 2007, in Miami FL, by Applied Research Laboratories (ARL), in accordance with ARI Standard 470-2001; using a Rheem 13 S.E.E.R. matched air handler and condensing unit (A/C) and a DYNAMAX model 50RA Heat Recovery Unit (HRU).

Testing was performed to determine the rate of heat transfer between the A/C and water heater. This heat transfer can be expressed both as the flow of BTU's per hour of condenser run time and also as the number of gallons of water heated per hour of condenser run time.

Additional testing was performed to compare the power consumption of the condenser without the operation of the HRU as opposed to the power consumption of the condenser with the HRU in operation. The comparative power consumption can be expressed both as a % reduction in power and also as an effective change in S.E.E.R.

Test results are as follows:

1.) Heat Transfer Rate: The rate of heat transfer into the water heater varied as a function of water flow rate. Across the range of 0.5 to 2.0 gallons per minute, the rate of heat transfer varied from 9064 BTU/hr to 11146 BTU/hr. This range of heat transfer rate can also be expressed as 21.4 to 26.3 gallons of water heated from 70 degrees to120 degrees per hour.

2.) Comparative Power Consumption: A/C condenser power consumption dropped from 5704 watts without the HRU operating to 4853 watts with the HRU operating. HRU operation used 101 watts. Taking the HRU power consumption into account, the comparative power consumption test indicated a reduction of 13% resulting from the HRU operation. This can also be expressed as an effective change in S.E.E.R. from 13 to 14.7.

The details of the actual testing and its measured results are contained in the full report; as are the calculations used to determine the test results. This Test Report has been reviewed, certified and sealed by a registered Professional Engineer. These are not Manufacturer's Test Results.

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Performance Report
30819

Doucette Industries, Inc.
20 Leigh Drive
York, PA 17406

Heat Recovery Unit (HRU)

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Lab Number: 30819

Client: Doucette Industries, Inc.
20 Leigh Drive
York, PA 17406

Test Method: ARI Standard 470-2001

Product: Heat Recovery Unit (HRU)

REPORT OF TEST

1.0 INTRODUCTION

1.1 Doucette Industries, Inc., of York, PA, retained Applied Research Laboratories (ARL) to conduct a performance test on a Heat Recovery Unit (HRU)(Model 50 RA). A performance test was conducted by ARL Engineer, E. John Lanager.

1.2 The testing program was authorized by an ARL Work Authorization Form (WAF) signed by Mr. John E. Lebo, President, of Doucette Industries, Inc., on June 1, 2007.

2.0 SAMPLE IDENTIFICATION

2.1 The client supplied ARL with one (1) Heat Recovery Unit (Model 50 RA) manufactured by Doucette Industries, Inc., one (1) Condensing Unit and one (1) Evaporating Unit.

2.2 Photographs of the units can be seen on the following photographs.

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Photograph 1
Heat Recovery Unit (Model 50 RA)

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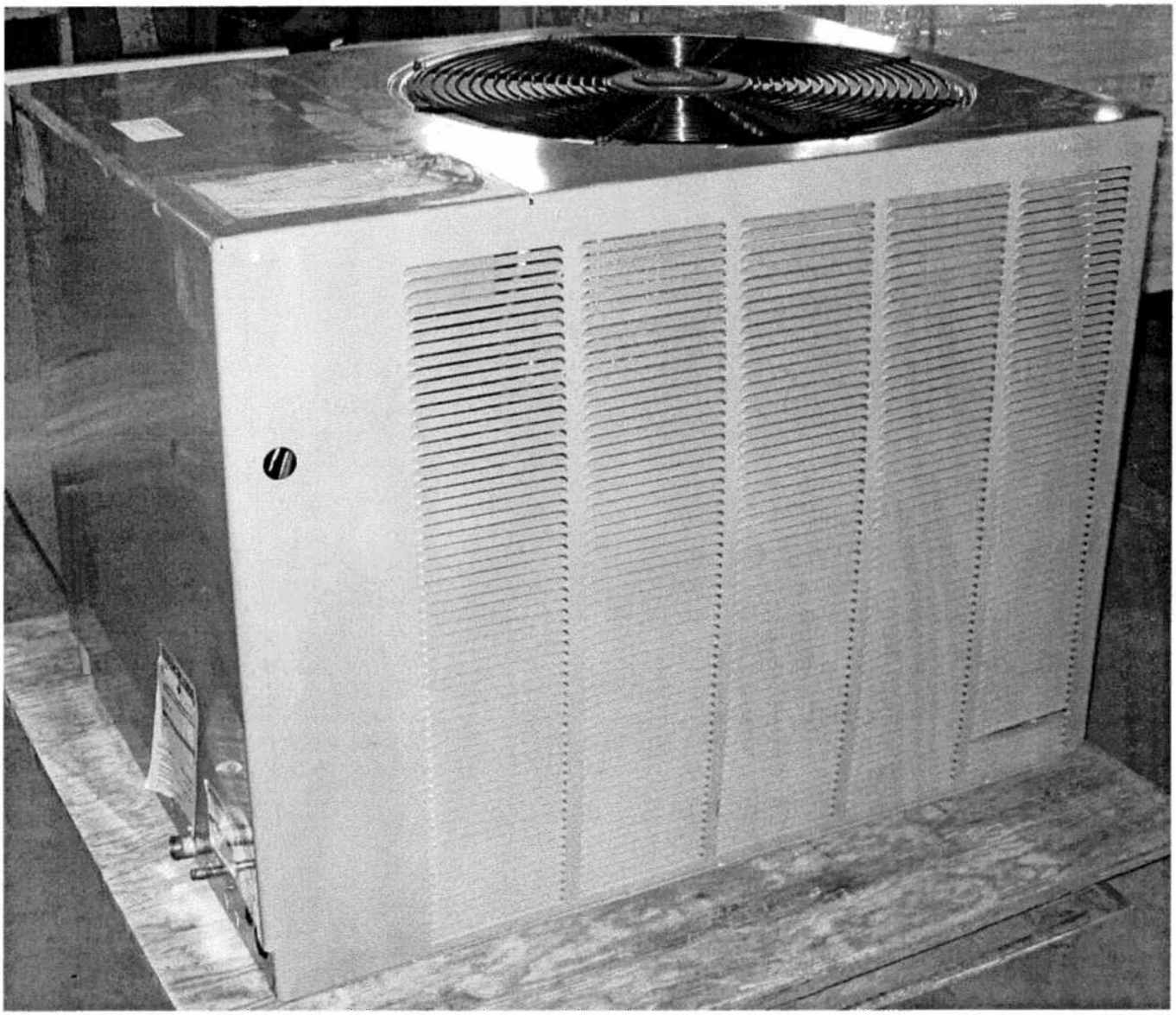
Photograph 2
Condensing Unit



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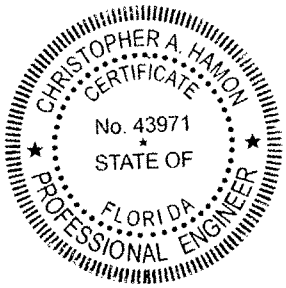
Photograph 3
Evaporating Unit



2.3 The specifications of the units are listed below:

Heat Recovery Unit
- Doucette Industries
- Model: 50RA
- Serial Number: None
- 230V, single-phase, 60Hz
- 0.6A, 1 Hp
- Water Pressure: 150psi

Condensing Unit
- Rheem
- Model: RAND-0160JAZ
- Serial Number: 7307 M1507 05957
- 208/230V, single-phase, 60Hz
- Date Manufactured: 04/2007
- SEER Rating: 13.0
- Compressor
  - RLA: 25.3/25.3
  - LRA: 150
- Outdoor Fan Motor
  - FLA: 1.2
  - 1/5 Hp
- Minimum Circuit Ampacity: 33/33A
- Refrigerant: R-22

Evaporating Unit
- Rheem
- Model: RHLA HM6024JA
- Serial Number: M2707 04565
- Date Manufactured: 07/2007
- 208/240V, single-phase, 60Hz
- Motor Hp/FLA: ¾Hp/4.6A
- AFUE Rating: 100.0

3.0 TEST METHOD

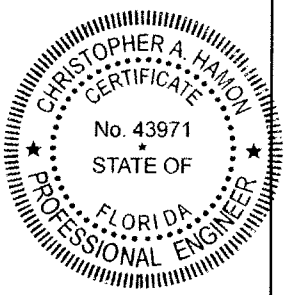
3.1 The Heat Recovery, Condensing and Evaporating units were installed as a system in the psychrometric test room at ARL.

3.2 The system was installed and instrumented in accordance with ARI Standard 470-2001 for Desuperheater/Water Heaters and manufacturer's instructions.

3.3 The following parameters were monitored:

1. Refrigerant Temperature Entering the HRU
2. Refrigerant Temperature Leaving the HRU
3. Water Temperature Entering the HRU
4. Water Temperature Leaving the HRU
5. Water Flow Rate
6. Refrigerant Flow Rate
7. Refrigerant Pressure to HRU
8. Refrigerant Pressure from HRU
9. Water Pressure to HRU
10. Water Pressure from HRU
11. High Side Pressure
12. Low Side Pressure
13. Compressor Power
14. HRU Power

3.4 The system was charged using R-22 refrigerant.



4.0 DATA

4.1 The following test data was collected:

Test Data

Refrigerant Temp Entering HRU (psi)	Refrigerant Temp Leaving HRU (psi)	Water Temp Entering HRU (°F)	Water Temp Leaving HRU (°F)	Water Flow Rate (gpm)	Refrigerant Flow Rate (lbs/hr)	Refrigerant Pressure to HRU (psig)
178.7	121.0	82.8	119.0	0.5	740	225
178.8	110.4	83.6	105.1	1.0	730	225
178.9	111.9	90.8	105.4	1.5	730	225
178.2	113.6	95.0	106.2	2.0	730	225

Refrigerant Pressure to HRU (psia)	Refrigerant Pressure from HRU (psig)	Refrigerant Pressure from HRU (psia)	Water Pressure to HRU (psi)	Water Pressure from HRU (psi)	High Side Pressure (psi)	Low Side Pressure (psi)
239.7	220	234.7	59	60	210	70
239.7	220	234.7	59	61	215	70
239.7	220	234.7	58	60	215	70
239.7	220	234.7	60	57	215	70

Enthalpy Entering HRU (Btu/lb)	Enthalpy Leaving HRU (Btu/lb)
128	116
128	113
128	113
128	114

Compressor Power Before DSH Turned On		
Volts	Amps	Watts
230	24.80	5704.0

Compressor Power After DSH Turned On		
Volts	Amps	Watts
230	21.10	4853.0

DSH Power		
Volts	Amps	Watts
230	0.44	101.2

5.0 EQUATIONS

5.1 The following equation was used to calculate the Heating Capacity on the Water Side of the System ($Btuh_{water}$):

$Btuh_{water}$ = [60 (minutes/hour)] * [flow rate (gpm)] * [8.33 (lbs/gallon of water)] * [ΔT (°F)]

5.2 The following equation was used to calculate the Heating Capacity on the Refrigerant Side of the System ($Btuh_{refrigerant}$):

$Btuh_{refrigerant}$ = [refrigerant flow rate (lbs/hr)] * [Δ Enthalpy of refrigerant (Btu/lb)]

5.2.1 A standard Pressure-Enthalpy Diagram for R-22 Refrigerant was used to determine the enthalpy of the refrigerant. The points corresponding to refrigerant pressure and temperature were located on the diagram. With this information, the enthalpy was determined.

6.0 RESULTS

6.1 Water Flow Rate = 0.5 gpm

6.1.1 Water Side

$Btuh_{water}$ = [60 (minutes/hour)] * [flow rate (gpm)] * [8.33 (lbs/gallon of water)] * [ΔT (°F)]

$Btuh_{water}$ = [60 (minutes/hour)] * [0.5 (gpm)] * [8.33 (lbs/gallon of water)] * [119.04 - 82.77 (°F)]

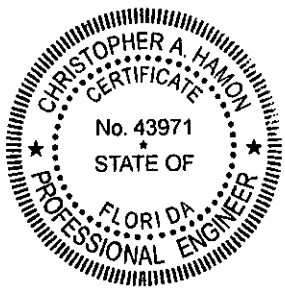
$Btuh_{water}$ = 9,063.9 Btuh

6.1.2 Refrigerant Side

$Btuh_{refrigerant}$ = [refrigerant flow rate (lbs/hr)] * [Δ Enthalpy of refrigerant (Btu/lb)]

$Btuh_{refrigerant}$ = [740 (lbs/hour)] * [128 - 116 (Btu/lb)]

$Btuh_{refrigerant}$ = 8,880 Btuh



6.2 Water Flow Rate = 1.0 gpm

6.2.1 Water Side

$Btuh_{water}$ = [60 (minutes/hour)] * [flow rate (gpm)] * [8.33 (lbs/gallon of water)] * [ΔT (°F)]

$Btuh_{water}$ = [60 (minutes/hour)] * [1.0 (gpm)] * [8.33 (lbs/gallon of water)] * [105.12 - 83.55 (°F)]

$Btuh_{water}$ = 10,780.7 Btuh

6.2.2 Refrigerant Side

$Btuh_{refrigerant}$ = [refrigerant flow rate (lbs/hr)] * [Δ Enthalpy of refrigerant (Btu/lb)]

$Btuh_{refrigerant}$ = [730 (lbs/hour)] * [128 - 113 (Btu/lb)]

$Btuh_{refrigerant}$ = 10,950 Btuh

6.3 Water Flow Rate = 1.5 gpm

6.3.1 Water Side

$Btuh_{water}$ = [60 (minutes/hour)] * [flow rate (gpm)] * [8.33 (lbs/gallon of water)] * [ΔT (°F)]

$Btuh_{water}$ = [60 (minutes/hour)] * [1.5 (gpm)] * [8.33 (lbs/gallon of water)] * [105.40 - 90.75 (°F)]

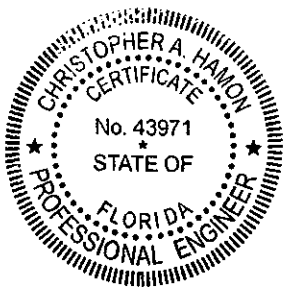
$Btuh_{water}$ = 10,983.1 Btuh

6.3.2 Refrigerant Side

$Btuh_{refrigerant}$ = [refrigerant flow rate (lbs/hr)] * [Δ Enthalpy of refrigerant (Btu/lb)]

$Btuh_{refrigerant}$ = [730 (lbs/hour)] * [128 - 113 (Btu/lb)]

$Btuh_{refrigerant}$ = 10,950 Btuh



6.4 Water Flow Rate = 2.0 gpm

6.4.1 Water Side

$Btuh_{water}$ = [60 (minutes/hour)] * [flow rate (gpm)] * [8.33 (lbs/gallon of water)] * [ΔT (°F)]

$Btuh_{water}$ = [60 (minutes/hour)] * [2.0 (gpm)] * [8.33 (lbs/gallon of water)] * [106.19 - 95.04 (°F)]

$Btuh_{water}$ = 11,145.5 Btuh

6.4.2 Refrigerant Side

$Btuh_{refrigerant}$ = [refrigerant flow rate (lbs/hr)] * [Δ Enthalpy of refrigerant (Btu/lb)]

$Btuh_{refrigerant}$ = [730 (lbs/hour)] * [128 - 114 (Btu/lb)]

$Btuh_{refrigerant}$ = 10,220 Btuh

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6.5 These results pertain only to the units tested and may not be representative of on-going production.

END OF REPORT

Report by:

E. John Lanager,
Project Engineer

Date: 10/1/07

Reviewed by:

Alan B. Sukert,
Director of Engineering

Date: 10/1/07

Reviewed by:

Christopher A. Hamon, P.E.,
Manager, Engineering Services

Date: 10/3/07

Note

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