



**Air-Conditioning, Heating, and Refrigeration
Institute (AHRI) Low-GWP Alternative Refrigerants
Evaluation Program (Low-GWP AREP)**

TEST REPORT #47

System Drop-in Test of R-32 and Refrigerant Blends ARM-71a, HPR2A, L-41-2 and DR-5A in a Five-Ton R-410A Rooftop Packaged Unit

Dutch Uselton
Travis Crawford

Lennox Industries, Inc.
Product Development and Research Center
1600 Metrocrest Drive
Carrollton, Texas
75006

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**This report has been made available to the public
as part of the author company's participation in the
AHRI's Low-GWP AREP.**



Air-Conditioning, Heating, and Refrigeration Institute
2111 Wilson Boulevard, Suite 500
Arlington VA 22201
(703) 524-8800
www.ahrinet.org

1. Introduction:

This document reports performance testing conducted on a 5 Ton rooftop packaged air-conditioner, designed for operation with R410A. It was tested with R410A, R32 and the following new low-GWP refrigerants: Arkema ARM-71a, Chemours DR-5A, Honeywell L-41-2 and Mexichem HPR2A. This testing occurred during the spring of 2015 at the Lennox Product Development and Research Center in Carrollton, TX.

The motivation for this work was to investigate the suitability of lower Global Warming Potential (GWP) refrigerants as candidate replacements for the HFC refrigerant: R410A. These refrigerants have GWPs (AR4, 2007 Assessment) of:

R410A – 2088

R32 – 675

The new candidates have GWPs (manufacturer supplied information) of:

ARM71A < 500

DR-5A = 466

L-41-2 = 572

HPR2A = 600.

2. Details of Test Setup:

a. Description of System

The unit is designated as an LGH060H4ESP and it was built in 2007 (Lab Inventory Control # 28759). This R410A air conditioner uses a scroll-type compressor and has a thermostatic expansion valve for refrigerant flow control. The compressor uses the POE oil that Emerson Climate Technologies provides with its scroll air conditioning compressors. The air flow was set for nominal 1750 CFM.

The ratings for this system were:

LGH060H4ESP

AHRI Classification: SP-A

Cooling Capacity (BTUH): 60,000

EER Rating: 12.7

This system tested 107% of “A” capacity, and 104% of “A” EER.

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b. Description of Modifications to System

A refrigerant flow meter was placed in the liquid line. Pressure taps were placed at the liquid line at the condenser, on the compressor suction and discharge lines and on the liquid line at the inlet to the expansion valve. Thermocouples were placed on the outside of refrigerant piping. An adjustable stem was placed on the expansion valve to enable some superheat adjustment.

c. Description of Tests Conducted

The air conditioner was evaluated using a pair of psychrometric test chambers. The supply air outlet of the air conditioner was connected to an AMCA 210 Code Tester. The air is returned to the Indoor Room. The return air to the unit is drawn from the Indoor Room through a duct. There are dry bulb/wet bulb temperature samplers on the inlet and outlet conditioned air stream. This enables measurement of air side capacity. A Coriolis-type flow meter is used to determine refrigerant mass flow rate. With temperature and pressure sensors to establish refrigerant thermodynamic states, the refrigerant capacity can also be measured. An energy balance is determined between the two capacity measurements. The “air-side” capacity is always used for the reported capacity.

The psychrometric test facility is operated as a certified satellite facility and is under an annual calibration system traceable to NIST standards. All instruments (Test Room #7) had their calibration checked on August 8th, 2014. These are the principal instruments used for taking measurements:

Critical T’couples:	Type “T” - Moore Industries, Inc. M/N TIY T2 Accuracy: +/-0.35F (individually further calibrated to +/-0.20F)
General T”couples:	Type “T” - OPTO22 M/N AITM2-I Accuracy: +/-01.38F (individually further calibrated to +/-0.20F)
Air Flow Pressures:	Validyne M/N CD-15 Accuracy: +/-0.25% of full scale (Range: +/-5.5 in. H2O)
Refrigerant Pressures:	Druck, Inc. M/N PTX610 Accuracy: +/-0.10% of full scale (Range: 0.0 – 800 psig)
Refrigerant Flow Rate:	Micro-Motion Sensor M/N CMF-025 Micro-Motion Transmitter M/N RFT9739 Accuracy: +/-0.10% of full scale (Range: 0 – 1200 lbs/hr)
Watt-Hr Meter:	GE 700X3G215 Accuracy: +/- 2.0 % of reading
Watt Meter:	Yokogawa WT500 Accuracy: +/-0.1% of reading +/-0.1% of full scale (Range: 0 – 7kW)

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Four steady-state tests were conducted with each refrigerant. Testing was conducted to standards AHRI 210/240 and ASHRAE 37. There are two pages in this report for data from each of the 20 tests.

The compressor was “run-in” for 6 hours in a 125F outdoor room environment. All data presented is post run-in.

The approach taken was to charge the R410A system to achieve the subcooling and superheat values that matched production verification testing of this model’s performance on the AHRI 210/240 “B” test (82F outdoor temperature). When we tested with the other refrigerants, we charged the unit to achieve approximately the same subcooling on the “B” test. Generally, it was necessary to adjust the setting of indoor expansion valve to also match the original superheat. We did not exhaust the possible variations in charge and TXV settings to optimize performance. Some further efficiency gains might be possible with the alternate refrigerants.

At the end of the program, another set of R-410A tests was conducted to ensure that the compressor or system had not suffered any damage during the test program. The second R-410A test results were very similar to the first.

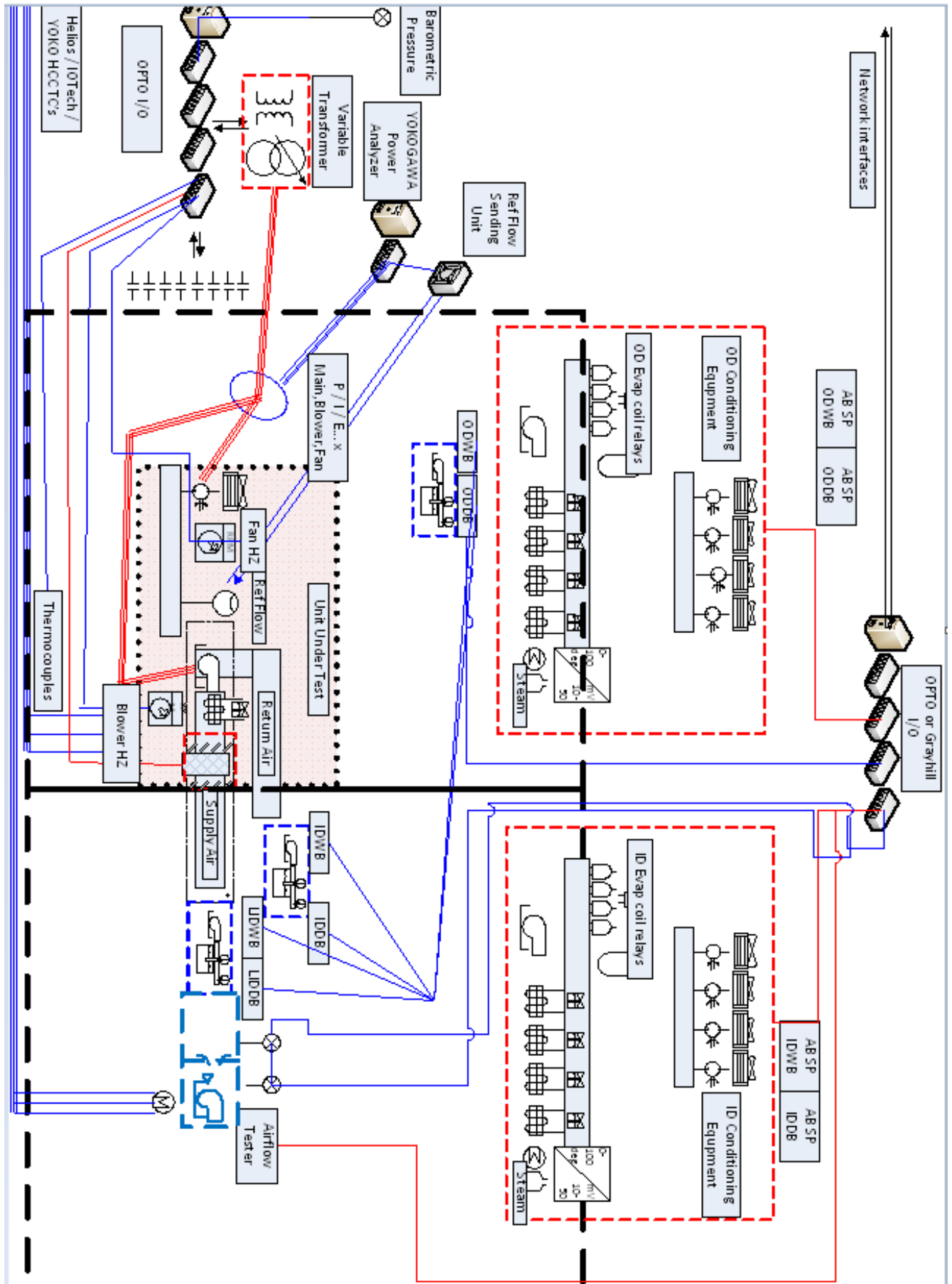


Figure 1. Diagram of Test Facility

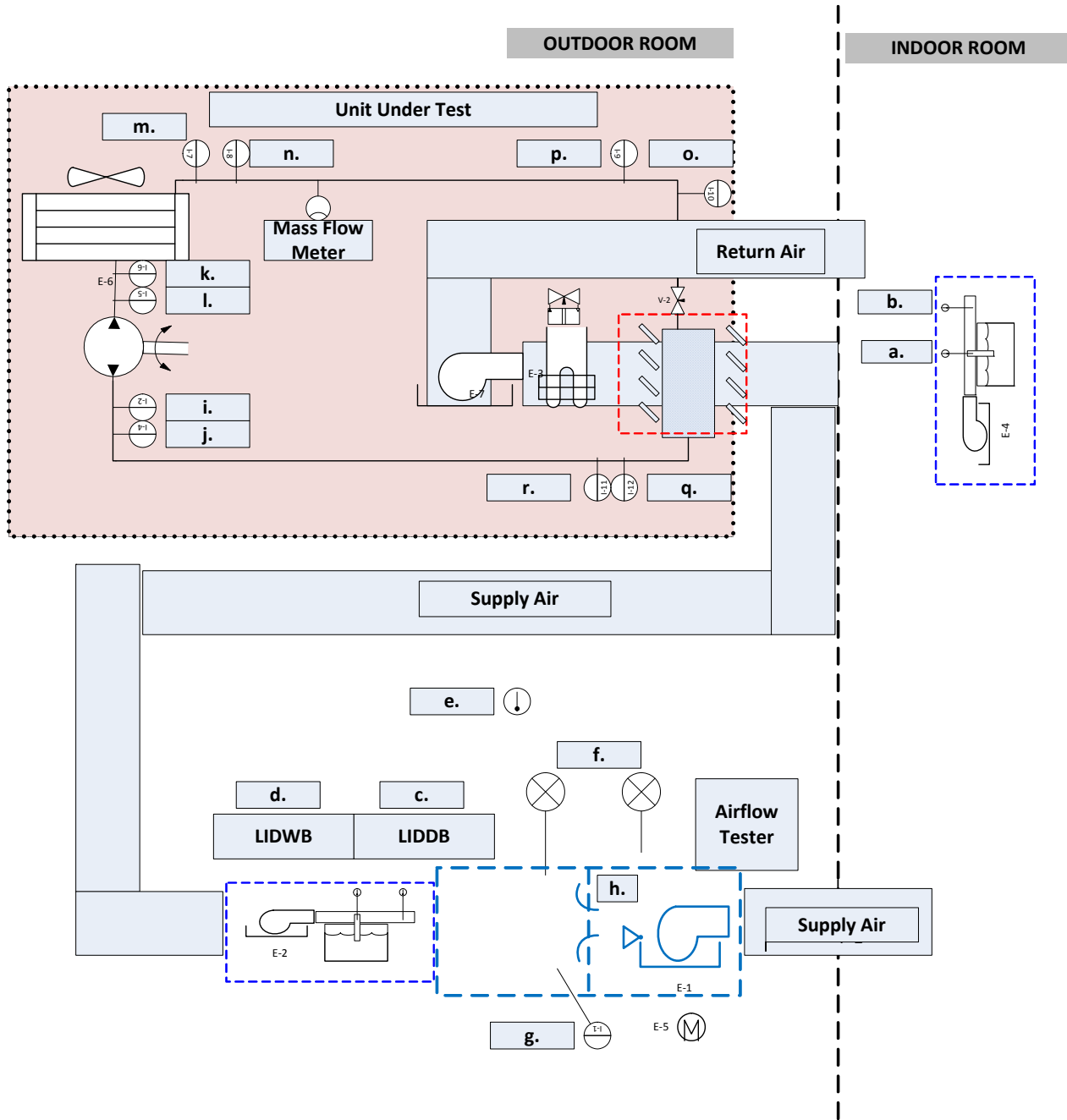


Figure 2. Schematic View of System Under Test

Legend for Instrumentation:

- a. Indoor Entering Dry Bulb Temp.
- b. Indoor Entering Wet Bulb Temp.
- c. Indoor Leaving Dry Bulb Temp.

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- d. Indoor Leaving Wet Bulb Temp.
- e. Outdoor Dry Bulb Temp.
- f. Air Flow Tester Nozzle Differential Pressure
- g. Temperature at Nozzle
- h. Nozzle Area
- i. Compressor Suction Temp.
- j. Compressor Suction Pressure
- k. Compressor Discharge Temp.
- l. Compressor Discharge Pressure
- m. Condenser Outlet Temp.
- n. Condenser Outlet Pressure
- o. TXV Inlet Temp.
- p. TXV Inlet Pressure
- q. Evaporator Outlet Temp.
- r. Evaporator Outlet Pressure

3. Results

R-410A gave the highest cooling capacity throughout the temperature range. At 105F outdoor temperature, and below, L-41-2 gave the lowest capacity. Above 105F, DR-5A gave the lowest capacity.

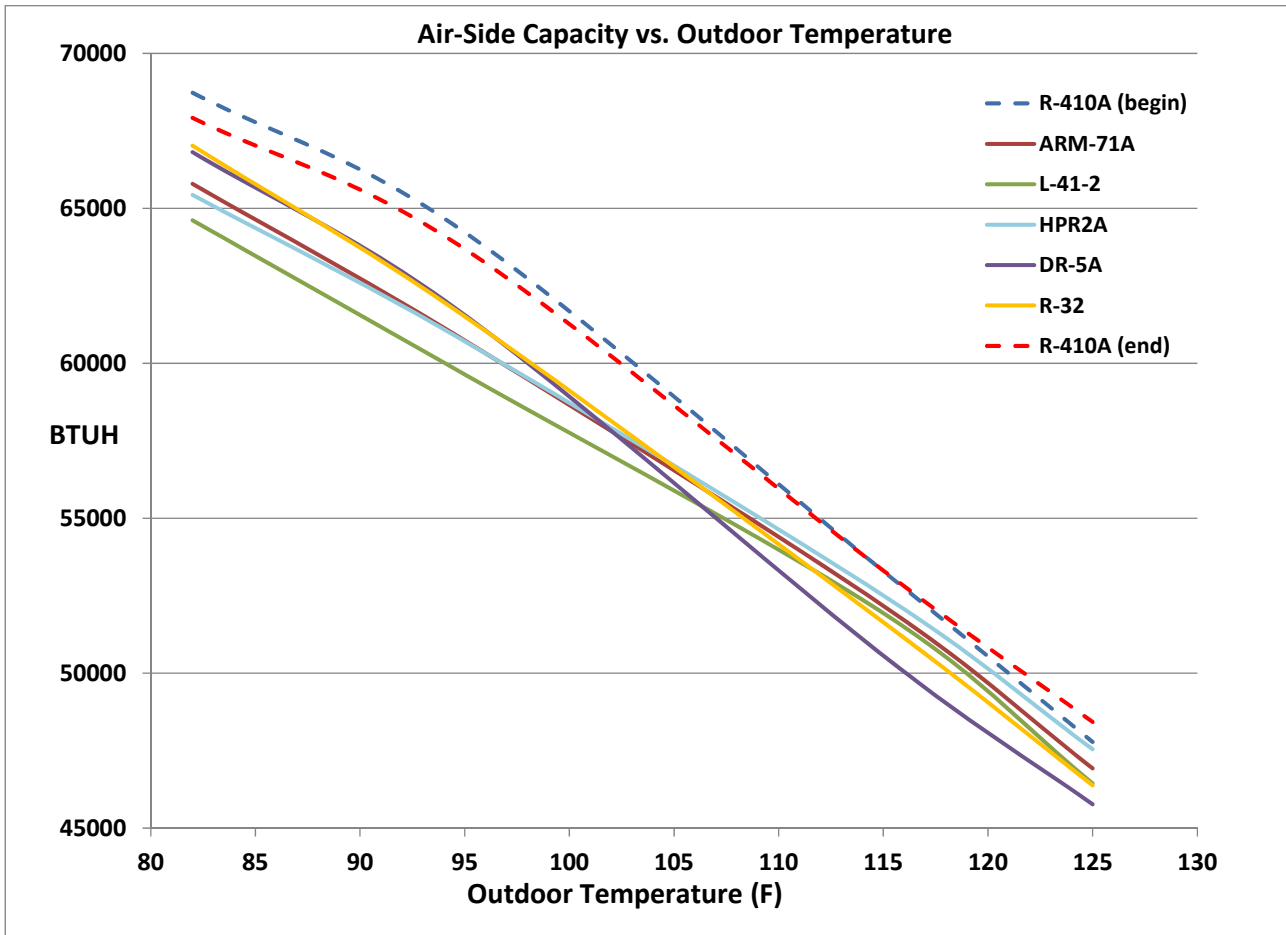


Figure 3. Comparison of Cooling Capacities (all refrigerants)

The EERs from these same tests are shown in the next figure. These refrigerants all show a similar pattern and are actually very close to each other in efficiency. R-32 appears to be the lowest.

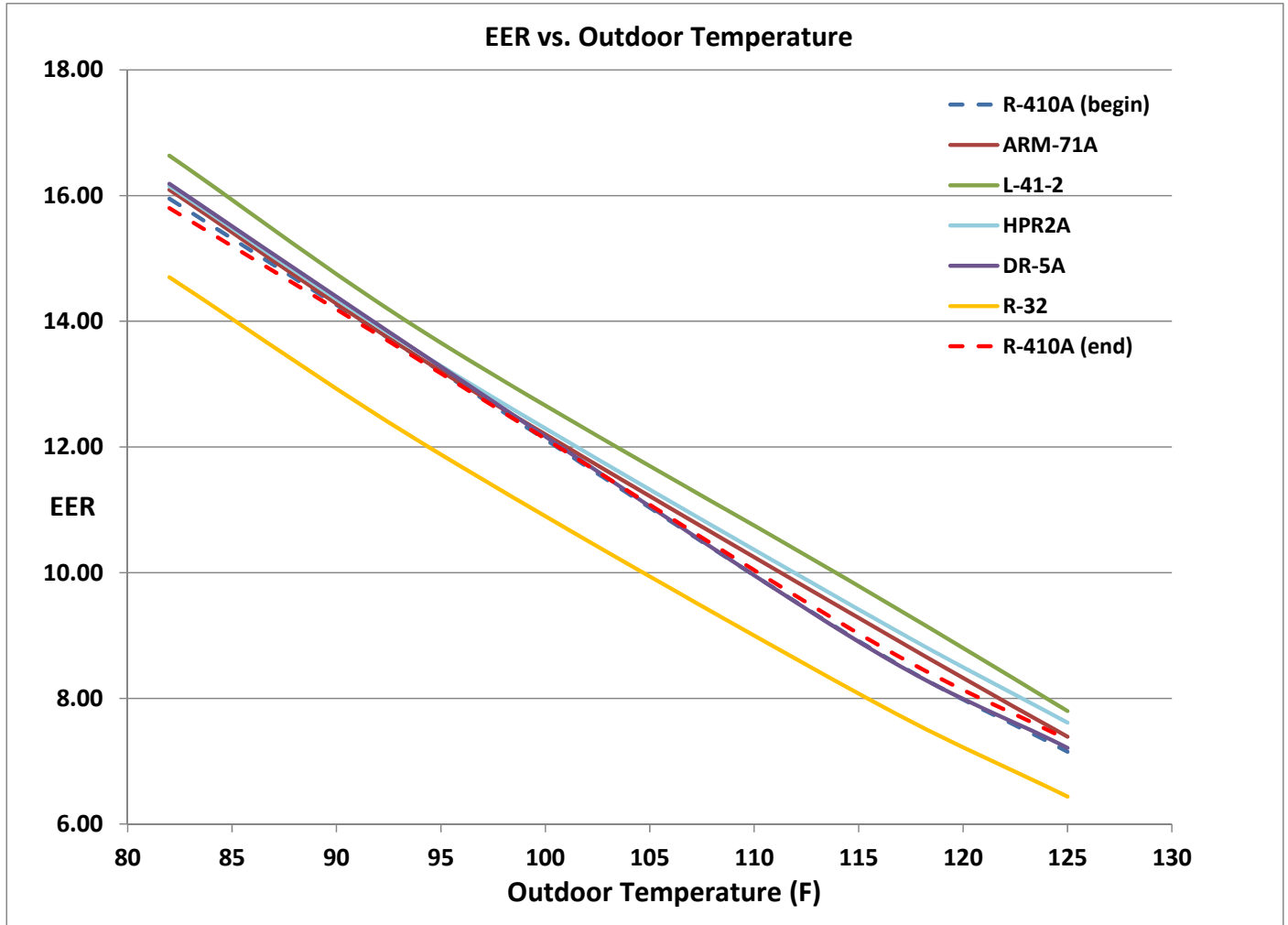


Figure 4. Comparison of Cooling EERs for these “drop-in” type tests (see text)

The reader must remember that in “drop-in” testing, the capacity and efficiency are not strictly comparable between refrigerants when their suction vapor densities are different. The results must be interpreted. If the suction vapor density is less than for R-410A then the mass flow rate through the compressor will be lower. If the latent heat of vaporization of the alternate refrigerant is not higher by enough to compensate for the lower mass flow rate, then the system capacity will be lower. As an example, here are some characteristics of L-41-2 compared to R-410A. The lower suction vapor density of L-41-2 more than outweighs the higher latent heat.

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	Saturated Density of Vapor at 45F	Latent Heat of Vaporization at 45F
Refrigerant	lbm/ft ³	BTU/lbm
R-410A	2.4	91.3
L-41-2	1.65	110.3

Table 1. Comparison of Selected Refrigerant Properties

The resultant effect is that, while the capacity is reduced, the efficiency will be artificially increased because the heat exchangers are now relatively unloaded in the drop-in type test.

An important characteristic of the alternate refrigerants is the compressor discharge temperature during high outdoor ambient temperature operation. High discharge temperatures can degrade the compressor oil that is circulating with the refrigerant.

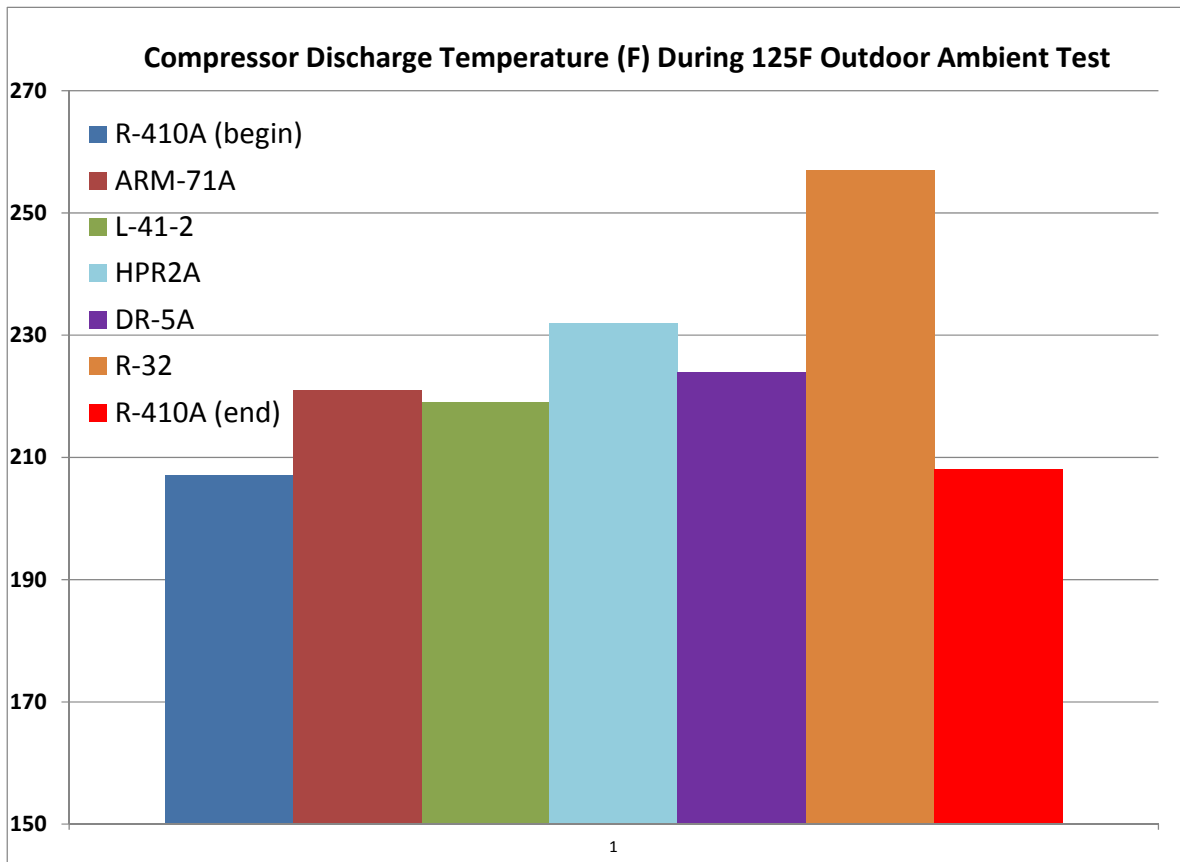


Figure 5. Comparison of Compressor Discharge Temp. during the 125F Outdoor Ambient Test

All of the alternate refrigerants had higher discharge temperatures compared to R-410A.

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4. Test Data

These pairs of pages show R-410A (baseline) compared to the Alternate Refrigerants.

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"B"				
				Alt. Refrig.:	L-41-2				
Manufacturer: Lennox Industries Inc.		Manufacturer's Notation: LGH060H4ESP							
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)		L-41-2							
Alternative Lubricant Type and ISO Viscosity		3MAF-POE							
Baseline Refrigerant and Lubricant		R-410A, 3MAF-POE							
Make and Model of System		Lennox, LGH060H4ESP							
Nominal Capacity and Type of System		5 Ton, Rooftop Air Conditioning Unit							
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	6.33	kg	14.82	13.96	lb	0.94	
Refrigerant Mass Flow Rate		395.0	289.2	kg/hr	871.0	637.7	lb/hr	0.73	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	80.00	F	
		wb	19.5	19.4	C	67.02	66.97	F	
	Outdoor	db	27.8	27.8	C	82.01	81.96	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		20138	18933	W	68731	64617	Btu/hr	0.94	
Sensible Capacity		13463	13255	W	45948	45240	Btu/hr	0.98	
Total System Power Input		4309	3885	W	4309	3885	W	0.90	
Compressor Power Input		3520	3088	W	3520	3088	W	0.88	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	15.95	16.63	Btuh/W	1.04	
Coeff. Of Performance (COP)		4.67	4.87					n/a	
Other System Changes									
System Data*					Base.	Alt.	Ratio		
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

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Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	50.3	m ³ /min	1759	1777	ft ³ /min	1.01
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	27.8	27.8	C	82	82	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	16.9	1070	19.3	946	62	155	67	137
Compressor Discharge	64.4	2347	69.2	2020	148	340	157	293
Condenser Inlet	64.4	2347	69.2	2020	148	340	157	293
Condenser Outlet	30.2	2266	29.7	1966	86	329	86	285
Expansion Device Inlet	29.1	2266	28.6	1966	84	329	84	285
Subcooling, at expan. device	7.8		7.2		14		13	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	17.2	1077	17.5	954	63	156	63	138
Evaporator Superheat	7.8		3.9		13		7	

Data Source(s) for Refrigerant Properties
NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

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Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"A"			
				Alt. Refrig.:	L-41-2			
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP					
Basic Information								
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			L-41-2					
Alternative Lubricant Type and ISO Viscosity			3MAF-POE					
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE					
Make and Model of System			Lennox, LGH060H4ESP					
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit					
Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	Base.
Mode (Heating/Cooling)			Cooling					
Compressor Type			scroll	scroll				
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min 1
Nominal Motor Size			4.5	4.5	hp			1
Motor Speed			3500	3500	rpm			1
Expansion Device Type			TXV	TXV				
Lubricant Charge			1.66	1.66	liter	56	56	ounce 1
Refrigerant Charge			6.72	6.33	kg	14.82	13.96	lb 0.94
Refrigerant Mass Flow Rate			396.18	292.63	kg/hr	873.6	645.3	lb/hr 0.74
Composition, at compr. inlet if applicable				n/a	% wt			
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	80.03	F
		wb	19.5	19.4	C	67.02	67.01	F
	Outdoor	db	35.0	35.0	C	95.00	95.01	F
		wb	n/a	n/a	C	n/a	n/a	F
Total Capacity			18819	17475	W	64230	59643	Btu/hr 0.93
Sensible Capacity			12889	12484	W	43989	42609	Btu/hr 0.97
Total System Power Input			4867	4367	W	4867	4367	W 0.90
Compressor Power Input			4062	3570	W	4062	3570	W 0.88
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	13.20	13.66	Btuh/W 1.03
Coeff. Of Performance (CCOP)			3.87	4.00				n/a
Other System Changes								
System Data*						Base.	Alt.	Ratio
Degradation Coefficient – Cd								
Seasonal Energy Efficiency Ratio - SEER								
Heating Seasonal Performance Factor - HSPF								
* Only Steady-State Cooling Tests Conducted								

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Type of System:	R-410A Single Package AC Unit			Alternate Refrigerant:				
Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio	
Evaporator								
Heat Exchange Fluid	Air							
Flow Rate (gas)	49.63	50.25	m ³ /min	1753	1775	ft ³ /min		
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a	
Inlet Temperature*	*	*	C	*	*	F		
Outlet Temperature*	*	*	C	*	*	F		
Condenser								
Heat Exchange Fluid	Air	Air						
Flow Rate (gas)	135.9	135.9	m ³ /min	4800	4800	ft ³ /min		
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a	
Inlet Temperature	35.0	35.0	C	95.0	95.0	F		
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F		
* see previous page								
Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	17.0	1082	20.0	966	63	157	68	140
Compressor Discharge	73.0	2744	78.5	2381	163	398	173	345
Condenser Inlet	73.0	2744	78.5	2381	163	398	173	345
Condenser Outlet	37.5	2670	37.2	2330	99	387	99	338
Expansion Device Inlet	35.9	2640	35.6	2330	97	383	96	338
Subcooling, at expan. device	7.9		6.5		14		12	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	18.0	1089	18.4	969	64	158	65	141
Evaporator Superheat	7.8		4.4		14		8	
j								
Data Source(s) for Refrigerant Properties								
NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer								
Additional Notes								
Submitted by: RBU Lennox Industries Inc.								

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Test: "115F"
 Alt. Refrig.: L-41-2

Manufacturer: Lennox Industries Inc. Manufacturer's Notation: LGH060H4ESP

Basic Information	
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)	L-41-2
Alternative Lubricant Type and ISO Viscosity	3MAF-POE
Baseline Refrigerant and Lubricant	R-410A, 3MAF-POE
Make and Model of System	Lennox, LGH060H4ESP
Nominal Capacity and Type of System	5 Ton, Rooftop Air Conditioning Unit

Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio
Mode (Heating/Cooling)			Cooling						
Compressor Type			scroll	scroll					
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min	1
Nominal Motor Size			4.5	4.5	hp				1
Motor Speed			3500	3500	rpm				1
Expansion Device Type			TXV	TXV					
Lubricant Charge			1.66	1.66	liter	56	56	ounce	1
Refrigerant Charge			6.72	6.33	kg	14.82	13.96	lb	0.94
Refrigerant Mass Flow Rate			403.6	296.1	kg/hr	890.0	652.9	lb/hr	0.73
Composition, at compr. inlet if applicable				n/a	% wt				
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	80.00	F	
		wb	19.4	19.4	C	66.99	66.98	F	
	Outdoor	db	46.1	46.1	C	115.01	115.04	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity			15199	15219	W	51874	51941	Btu/hr	1.00
Sensible Capacity			12673	11413	W	43253	38952	Btu/hr	0.90
Total System Power Input			6047	5307	W	6047	5307	W	0.88
Compressor Power Input			5227	4506	W	5227	4506	W	0.86
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	8.58	9.79	Btuh/W	1.14
Coeff. Of Performance (COP)			2.51	2.87					n/a

Other System Changes									

System Data*	Base.	Alt.	Ratio
Degradation Coefficient – Cd			
Seasonal Energy Efficiency Ratio - SEER			
Heating Seasonal Performance Factor - HSPF			

* Only Steady-State Cooling Tests Conducted

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.7	50.1	m ³ /min	1756	1768	ft ³ /min	1.01
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	46.1	46.1	C	115	115	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	19.5	1131	21.0	998	67	164	70	145
Compressor Discharge	88.6	3458	94.1	3025	191	501	201	439
Condenser Inlet	88.6	3458	94.1	3025	191	501	201	439
Condenser Outlet	47.8	3379	48.4	2976	118	490	119	432
Expansion Device Inlet	46.0	3379	46.4	2976	115	490	116	432
Subcooling, at expan. device	8.0		6.7		14		12	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	19.9	1136	19.4	1003	68	165	67	145
Evaporator Superheat	7.8		4.4		15		8	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"125F"				
				Alt. Refrig.:	L-41-2				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			L-41-2						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio
Mode (Heating/Cooling)			Cooling						
Compressor Type			scroll	scroll					
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min	1
Nominal Motor Size			4.5	4.5	hp				1
Motor Speed			3500	3500	rpm				1
Expansion Device Type			TXV	TXV					
Lubricant Charge			1.66	1.66	liter	56	56	ounce	1
Refrigerant Charge			6.72	6.33	kg	14.82	13.96	lb	0.94
Refrigerant Mass Flow Rate			406.1	293.2	kg/hr	895.5	646.6	lb/hr	0.72
Composition, at compr. inlet if applicable				n/a	% wt				
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	79.99	F	
		wb	19.4	19.4	C	67.00	67.00	F	
	Outdoor	db	51.7	51.7	C	125.06	125.05	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity			13773	13608	W	47008	46446	Btu/hr	0.99
Sensible Capacity			12420	10703	W	42389	36530	Btu/hr	0.86
Total System Power Input			6663	5956	W	6663	5956	W	0.89
Compressor Power Input			5227	5137	W	5227	5137	W	0.98
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	7.05	7.80	Btuh/W	1.11
Coeff. Of Performance (COP)			2.07	2.28					n/a
Other System Changes									
System Data*						Base.	Alt.	Ratio	
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	49.9	m ³ /min	1757	1760	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	51.7	51.7	C	125	125	F	
Outlet Temperature	(not measured)	(not measured)	C	(not measured)	(not measured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	20.4	1161	21.7	1008	69	168	71	146
Compressor Discharge	96.6	3837	103.9	3377	206	557	219	490
Condenser Inlet	96.6	3837	103.9	3377	206	557	219	490
Condenser Outlet	53.6	3762	54.4	3330	128	546	130	483
Expansion Device Inlet	51.5	3762	52.2	3330	125	546	126	483
Subcooling, at expan. device	7.3		6.0		13		11	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	20.2	1166	20.5	1016	68	169	69	147
Evaporator Superheat	7.8		5.1		14		9	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"B"				
				Alt. Refrig.:	ARM--71A				
Manufacturer: Lennox Industries Inc.				Manufacturer's Notation: LGH060H4ESP					
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)				ARM--71A					
Alternative Lubricant Type and ISO Viscosity				3MAF-POE					
Baseline Refrigerant and Lubricant				R-410A, 3MAF-POE					
Make and Model of System				Lennox, LGH060H4ESP					
Nominal Capacity and Type of System				5 Ton, Rooftop Air Conditioning Unit					
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ^3min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	6.00	kg	14.82	13.22	lb	0.89	
Refrigerant Mass Flow Rate		395.0	301.7	kg/hr	871.0	665.3	lb/hr	0.76	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	80.00	F	
		wb	19.5	19.4	C	67.02	67.00	F	
	Outdoor	db	27.8	27.8	C	82.01	82.00	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		20138	19739	W	68731	67369	Btu/hr	0.98	
Sensible Capacity		13463	13503	W	45948	46085	Btu/hr	1.00	
Total System Power Input		4309	4031	W	4309	4031	W	0.94	
Compressor Power Input		3520	3245	W	3520	3245	W	0.92	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	15.95	16.71	Btuh/W	1.05	
Coeff. Of Performance (COP)		4.67	4.90					n/a	
Other System Changes									
System Data*									
Degradation Coefficient – Cd					Base.	Alt.	Ratio		
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	50.3	m ³ /min	1759	1778	ft ³ /min	1.01
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	27.8	27.8	C	82	82	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	16.9	1070	20.2	990	62	155	68	144
Compressor Discharge	64.4	2347	70.5	2127	148	340	159	309
Condenser Inlet	64.4	2347	70.5	2127	148	340	159	309
Condenser Outlet	30.2	2266	30.1	2070	86	329	86	300
Expansion Device Inlet	29.1	2266	29.1	2070	84	329	84	300
Subcooling, at expan. device	7.8		5.4		14		10	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	17.2	1077	18.2	995	63	156	65	144
Evaporator Superheat	7.8		7.3		13		13	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"A"				
				Alt. Refrig.:	ARM--71A				
Manufacturer: Lennox Industries Inc.				Manufacturer's Notation: LGH060H4ESP					
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			ARM--71A						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio
Mode (Heating/Cooling)			Cooling						
Compressor Type			scroll	scroll					
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min	1
Nominal Motor Size			4.5	4.5	hp				1
Motor Speed			3500	3500	rpm				1
Expansion Device Type			TXV	TXV					
Lubricant Charge			1.66	1.66	liter	56	56	ounce	1
Refrigerant Charge			6.72	6.00	kg	14.82	13.22	lb	0.89
Refrigerant Mass Flow Rate			396.18	306.26	kg/hr	873.6	675.3	lb/hr	0.77
Composition, at compr. inlet if applicable				n/a	% wt				
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	80.02	F	
		wb	19.5	19.4	C	67.02	66.99	F	
	Outdoor	db	35.0	35.0	C	95.00	95.03	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity			18819	18118	W	64230	61837	Btu/hr	0.96
Sensible Capacity			12889	12784	W	43989	43632	Btu/hr	0.99
Total System Power Input			4867	4538	W	4867	4538	W	0.93
Compressor Power Input			4062	3746	W	4062	3746	W	0.92
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	13.20	13.63	Btuh/W	1.03
Coeff. Of Performance (CCOP)			3.87	3.99					n/a
Other System Changes									
System Data*						Base.	Alt.	Ratio	
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant:

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.63	50.32	m ³ /min	1753	1777	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.9	135.9	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	35.0	35.0	C	95.0	95.0	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	17.0	1082	20.7	1011	63	157	69	147
Compressor Discharge	73.0	2744	79.4	2502	163	398	175	363
Condenser Inlet	73.0	2744	79.4	2502	163	398	175	363
Condenser Outlet	37.5	2670	37.7	2448	99	387	100	355
Expansion Device Inlet	35.9	2640	36.2	2448	97	383	97	355
Subcooling, at expan. device	7.9		5.3		14		10	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	18.0	1089	19.2	1020	64	158	67	148
Evaporator Superheat	7.8		7.5		14		14	

Data Source(s) for Refrigerant Properties
NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"115F"				
				Alt. Refrig.:	ARM--71A				
Manufacturer: Lennox Industries Inc.				Manufacturer's Notation: LGH060H4ESP					
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)				ARM--71A					
Alternative Lubricant Type and ISO Viscosity				3MAF-POE					
Baseline Refrigerant and Lubricant				R-410A, 3MAF-POE					
Make and Model of System				Lennox, LGH060H4ESP					
Nominal Capacity and Type of System				5 Ton, Rooftop Air Conditioning Unit					
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	6.00	kg	14.82	13.22	lb	0.89	
Refrigerant Mass Flow Rate		403.6	312.3	kg/hr	890.0	688.6	lb/hr	0.77	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	79.98	F	
		wb	19.4	19.4	C	66.99	67.01	F	
	Outdoor	db	46.1	46.1	C	115.01	115.05	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		15199	14698	W	51874	50163	Btu/hr	0.97	
Sensible Capacity		12673	11160	W	43253	38091	Btu/hr	0.88	
Total System Power Input		6047	5521	W	6047	5521	W	0.91	
Compressor Power Input		5227	4721	W	5227	4721	W	0.90	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	8.58	9.09	Btuh/W	1.06	
Coeff. Of Performance (COP)		2.51	2.66					n/a	
Other System Changes									
System Data*					Base.	Alt.	Ratio		
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.7	50.1	m ³ /min	1756	1771	ft ³ /min	1.01
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	46.1	46.1	C	115	115	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	19.5	1131	21.9	1051	67	164	71	153
Compressor Discharge	88.6	3458	94.7	3165	191	501	202	459
Condenser Inlet	88.6	3458	94.7	3165	191	501	202	459
Condenser Outlet	47.8	3379	49.1	3112	118	490	120	451
Expansion Device Inlet	46.0	3379	47.3	3112	115	490	117	451
Subcooling, at expan. device	8.0		0.0		14		0	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	19.9	1136	20.9	1059	68	165	70	154
Evaporator Superheat	7.8		6.9		15		12	

Data Source(s) for Refrigerant Properties
NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"125F"				
				Alt. Refrig.:	ARM--71A				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			ARM--71A						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	6.00	kg	14.82	13.22	lb	0.89	
Refrigerant Mass Flow Rate		406.1	310.6	kg/hr	895.5	685.0	lb/hr	0.76	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	79.99	F	
		wb	19.4	19.4	C	67.00	66.95	F	
	Outdoor	db	51.7	51.7	C	125.06	125.00	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		13773	14058	W	47008	47982	Btu/hr	1.02	
Sensible Capacity		12420	10942	W	42389	37345	Btu/hr	0.88	
Total System Power Input		6663	6145	W	6663	6145	W	0.92	
Compressor Power Input		5227	5334	W	5227	5334	W	1.02	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	7.05	7.81	Btuh/W	1.11	
Coeff. Of Performance (COP)		2.07	2.29					n/a	
Other System Changes									
System Data*					Base.	Alt.	Ratio		
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	50.0	m ³ /min	1757	1767	ft ³ /min	1.01
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	51.7	51.7	C	125	125	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	20.4	1161	23.4	1069	69	168	74	155
Compressor Discharge	96.6	3837	104.2	3524	206	557	220	511
Condenser Inlet	96.6	3837	104.2	3524	206	557	220	511
Condenser Outlet	53.6	3762	55.3	3467	128	546	132	503
Expansion Device Inlet	51.5	3762	53.2	3467	125	546	128	503
Subcooling, at expan. device	7.3		4.1		13		7	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	20.2	1166	21.0	1075	68	169	70	156
Evaporator Superheat	7.8		6.8		14		12	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"B"			
				Alt. Refrig.:	HPR2A			
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP					
Basic Information								
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			HPR2A					
Alternative Lubricant Type and ISO Viscosity			3MAF-POE					
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE					
Make and Model of System			Lennox, LGH060H4ESP					
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit					
Comparison Data								
			Base.	Alt.	SI Units	Base.	Alt.	Base.
Mode (Heating/Cooling)			Cooling					
Compressor Type			scroll	scroll				
Compressor Displacement			0.229	0.229	m ³ /min		ft ³ /min	1
Nominal Motor Size			4.5	4.5	hp			1
Motor Speed			3500	3500	rpm			1
Expansion Device Type			TXV	TXV				
Lubricant Charge			1.66	1.66	liter	56	56	ounce
Refrigerant Charge			6.72	6.14	kg	14.82	13.54	lb
Refrigerant Mass Flow Rate			395.0	276.3	kg/hr	871.0	609.2	lb/hr
Composition, at compr. inlet if applicable				n/a	% wt			
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	79.99	F
		wb	19.5	19.5	C	67.02	67.02	F
	Outdoor	db	27.8	27.8	C	82.01	81.98	F
		wb	n/a	n/a	C	n/a	n/a	F
Total Capacity			20138	19172	W	68731	65435	Btu/hr
Sensible Capacity			13463	13279	W	45948	45320	Btu/hr
Total System Power Input			4309	4051	W	4309	4051	W
Compressor Power Input			3520	3250	W	3520	3250	W
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	15.95	16.15	Btuh/W
Coeff. Of Performance (COP)			4.67	4.73				n/a
Other System Changes								
System Data*						Base.	Alt.	Ratio
Degradation Coefficient – Cd								
Seasonal Energy Efficiency Ratio - SEER								
Heating Seasonal Performance Factor - HSPF								
* Only Steady-State Cooling Tests Conducted								

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	50.4	m ³ /min	1759	1778	ft ³ /min	1.01
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	27.8	27.8	C	82	82	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	16.9	1070	21.4	975	62	155	70	141
Compressor Discharge	64.4	2347	74.8	2107	148	340	167	306
Condenser Inlet	64.4	2347	74.8	2107	148	340	167	306
Condenser Outlet	30.2	2266	29.5	2057	86	329	85	298
Expansion Device Inlet	29.1	2266	28.4	2057	84	329	83	298
Subcooling, at expan. device	7.8		7.3		14		13	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	17.2	1077	18.4	981	63	156	65	142
Evaporator Superheat	7.8		6.1		13		11	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"A"				
				Alt. Refrig.:	HPR2A				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			HPR2A						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	6.14	kg	14.82	13.54	lb	0.91	
Refrigerant Mass Flow Rate		396.18	278.06	kg/hr	873.6	613.1	lb/hr	0.70	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	80.00	F	
		wb	19.5	19.4	C	67.02	66.92	F	
	Outdoor	db	35.0	35.0	C	95.00	95.02	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		18819	17789	W	64230	60713	Btu/hr	0.95	
Sensible Capacity		12889	12619	W	43989	43069	Btu/hr	0.98	
Total System Power Input		4867	4569	W	4867	4569	W	0.94	
Compressor Power Input		4062	3769	W	4062	3769	W	0.93	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	13.20	13.29	Btuh/W	1.01	
Coeff. Of Performance (CCOP)		3.87	3.89					n/a	
Other System Changes									
System Data*					Base.	Alt.	Ratio		
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.63	50.30	m ³ /min	1753	1776	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.9	135.9	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	35.0	35.0	C	95.0	95.0	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	

* see previous page

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	17.0	1082	21.5	989	63	157	71	143
Compressor Discharge	73.0	2744	84.5	2484	163	398	184	360
Condenser Inlet	73.0	2744	84.5	2484	163	398	184	360
Condenser Outlet	37.5	2670	36.9	2436	99	387	98	353
Expansion Device Inlet	35.9	2640	35.3	2436	97	383	96	353
Subcooling, at expan. device	7.9		7.6		14		14	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	18.0	1089	18.9	995	64	158	66	144
Evaporator Superheat	7.8		6.2		14		11	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"115F"				
				Alt. Refrig.:	HPR2A				
Manufacturer: Lennox Industries Inc.				Manufacturer's Notation: LGH060H4ESP					
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)				HPR2A					
Alternative Lubricant Type and ISO Viscosity				3MAF-POE					
Baseline Refrigerant and Lubricant				R-410A, 3MAF-POE					
Make and Model of System				Lennox, LGH060H4ESP					
Nominal Capacity and Type of System				5 Ton, Rooftop Air Conditioning Unit					
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	6.14	kg	14.82	13.54	lb	0.91	
Refrigerant Mass Flow Rate		403.6	280.3	kg/hr	890.0	618.1	lb/hr	0.69	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	79.99	F	
		wb	19.4	19.4	C	66.99	67.00	F	
	Outdoor	db	46.1	46.1	C	115.01	115.02	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		15199	15385	W	51874	52510	Btu/hr	1.01	
Sensible Capacity		12673	11388	W	43253	38867	Btu/hr	0.90	
Total System Power Input		6047	5578	W	6047	5578	W	0.92	
Compressor Power Input		5227	4760	W	5227	4760	W	0.91	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	8.58	9.41	Btuh/W	1.10	
Coeff. Of Performance (COP)		2.51	2.76					n/a	
Other System Changes									
System Data*					Base.	Alt.	Ratio		
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.7	50.0	m ³ /min	1756	1767	ft ³ /min	1.01
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	46.1	46.1	C	115	115	F	
Outlet Temperature	(not measured)	(not measured)	C	(not measured)	(not measured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	19.5	1131	22.6	1024	67	164	73	148
Compressor Discharge	88.6	3458	101.2	3153	191	501	214	457
Condenser Inlet	88.6	3458	101.2	3153	191	501	214	457
Condenser Outlet	47.8	3379	48.1	3107	118	490	119	451
Expansion Device Inlet	46.0	3379	46.2	3107	115	490	115	451
Subcooling, at expan. device	8.0		7.2		14		13	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	19.9	1136	20.1	1030	68	165	68	149
Evaporator Superheat	7.8		7.8		15		11	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"125F"			
				Alt. Refrig.:	HPR2A			
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP					
Basic Information								
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			HPR2A					
Alternative Lubricant Type and ISO Viscosity			3MAF-POE					
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE					
Make and Model of System			Lennox, LGH060H4ESP					
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit					
Comparison Data								
			Base.	Alt.	SI Units	Base.	Alt.	Base.
Mode (Heating/Cooling)			Cooling					
Compressor Type			scroll	scroll				
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min 1
Nominal Motor Size			4.5	4.5	hp			1
Motor Speed			3500	3500	rpm			1
Expansion Device Type			TXV	TXV				
Lubricant Charge			1.66	1.66	liter	56	56	ounce 1
Refrigerant Charge			6.72	6.14	kg	14.82	13.54	lb 0.91
Refrigerant Mass Flow Rate			406.1	279.2	kg/hr	895.5	615.5	lb/hr 0.69
Composition, at compr. inlet if applicable				n/a	% wt			
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	80.00	F
		wb	19.4	19.4	C	67.00	66.93	F
	Outdoor	db	51.7	51.7	C	125.06	125.03	F
		wb	n/a	n/a	C	n/a	n/a	F
Total Capacity			13773	13931	W	47008	47547	Btu/hr 1.01
Sensible Capacity			12420	10782	W	42389	36798	Btu/hr 0.87
Total System Power Input			6663	6245	W	6663	6245	W 0.94
Compressor Power Input			5227	5426	W	5227	5426	W 1.04
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	7.05	7.61	Btuh/W 1.08
Coeff. Of Performance (COP)			2.07	2.23				n/a
Other System Changes								
System Data*						Base.	Alt.	Ratio
Degradation Coefficient – Cd								
Seasonal Energy Efficiency Ratio - SEER								
Heating Seasonal Performance Factor - HSPF								
* Only Steady-State Cooling Tests Conducted								

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	49.9	m ³ /min	1757	1762	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	51.7	51.7	C	125	125	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	20.4	1161	23.4	1039	69	168	74	151
Compressor Discharge	96.6	3837	111.0	3518	206	557	232	510
Condenser Inlet	96.6	3837	111.0	3518	206	557	232	510
Condenser Outlet	53.6	3762	54.3	3472	128	546	130	504
Expansion Device Inlet	51.5	3762	52.0	3472	125	546	126	504
Subcooling, at expan. device	7.3		6.8		13		12	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	20.2	1166	21.0	1045	68	169	70	152
Evaporator Superheat	7.8		7.8		14		12	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"B"			
				Alt. Refrig.:	DR-5A			
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP					
Basic Information								
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			DR-5A					
Alternative Lubricant Type and ISO Viscosity			3MAF-POE					
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE					
Make and Model of System			Lennox, LGH060H4ESP					
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit					
Comparison Data								
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio
Mode (Heating/Cooling)		Cooling						
Compressor Type		scroll	scroll					
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1
Nominal Motor Size		4.5	4.5	hp				1
Motor Speed		3500	3500	rpm				1
Expansion Device Type		TXV	TXV					
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1
Refrigerant Charge		6.72	6.35	kg	14.82	14	lb	0.94
Refrigerant Mass Flow Rate		395.0	308.5	kg/hr	871.0	680.3	lb/hr	0.78
Composition, at compr. inlet if applicable			n/a	% wt				
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	79.98	F
		wb	19.5	19.4	C	67.02	66.99	F
	Outdoor	db	27.8	27.8	C	82.01	81.98	F
		wb	n/a	n/a	C	n/a	n/a	F
Total Capacity		20138	19577	W	68731	66816	Btu/hr	0.97
Sensible Capacity		13463	13569	W	45948	46311	Btu/hr	1.01
Total System Power Input		4309	4128	W	4309	4128	W	0.96
Compressor Power Input		3520	3331	W	3520	3331	W	0.95
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	15.95	16.19	Btuh/W	1.01
Coeff. Of Performance (COP)		4.67	4.74					n/a
Other System Changes								
System Data*					Base.	Alt.	Ratio	
Degradation Coefficient – Cd								
Seasonal Energy Efficiency Ratio - SEER								
Heating Seasonal Performance Factor - HSPF								
* Only Steady-State Cooling Tests Conducted								

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	50.4	m ³ /min	1759	1778	ft ³ /min	1.01
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	27.8	27.8	C	82	82	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	16.9	1070	20.6	1012	62	155	69	147
Compressor Discharge	64.4	2347	71.6	2191	148	340	161	318
Condenser Inlet	64.4	2347	71.6	2191	148	340	161	318
Condenser Outlet	30.2	2266	29.5	2134	86	329	85	309
Expansion Device Inlet	29.1	2266	28.4	2134	84	329	83	309
Subcooling, at expan. device	7.8		7.2		14		13	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	17.2	1077	18.1	1021	63	156	65	148
Evaporator Superheat	7.8		7.8		13		14	

Data Source(s) for Refrigerant Properties
NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"A"				
				Alt. Refrig.:	DR-5A				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			DR-5A						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio
Mode (Heating/Cooling)			Cooling						
Compressor Type			scroll	scroll					
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min	1
Nominal Motor Size			4.5	4.5	hp				1
Motor Speed			3500	3500	rpm				1
Expansion Device Type			TXV	TXV					
Lubricant Charge			1.66	1.66	liter	56	56	ounce	1
Refrigerant Charge			6.72	6.35	kg	14.82	14	lb	0.94
Refrigerant Mass Flow Rate			396.18	310.21	kg/hr	873.6	684.0	lb/hr	0.78
Composition, at compr. inlet if applicable				n/a	% wt				
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	80.00	F	
		wb	19.5	19.5	C	67.02	67.01	F	
	Outdoor	db	35.0	35.0	C	95.00	94.95	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity			18819	18038	W	64230	61563	Btu/hr	0.96
Sensible Capacity			12889	12733	W	43989	43459	Btu/hr	0.99
Total System Power Input			4867	4637	W	4867	4637	W	0.95
Compressor Power Input			4062	3847	W	4062	3847	W	0.95
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	13.20	13.28	Btuh/W	1.01
Coeff. Of Performance (CCOP)			3.87	3.89					n/a
Other System Changes									
System Data*						Base.	Alt.	Ratio	
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.63	50.32	m ³ /min	1753	1777	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.9	135.9	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	35.0	35.0	C	95.0	94.9	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	17.0	1082	20.9	1027	63	157	70	149
Compressor Discharge	73.0	2744	80.7	2575	163	398	177	374
Condenser Inlet	73.0	2744	80.7	2575	163	398	177	374
Condenser Outlet	37.5	2670	36.7	2522	99	387	98	366
Expansion Device Inlet	35.9	2640	35.2	2522	97	383	95	366
Subcooling, at expan. device	7.9		8.2		14		15	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	18.0	1089	19.3	1035	64	158	67	150
Evaporator Superheat	7.8		7.7		14		14	

Data Source(s) for Refrigerant Properties
NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"115F"				
				Alt. Refrig.:	DR-5A				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			DR-5A						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio
Mode (Heating/Cooling)			Cooling						
Compressor Type			scroll	scroll					
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min	1
Nominal Motor Size			4.5	4.5	hp				1
Motor Speed			3500	3500	rpm				1
Expansion Device Type			TXV	TXV					
Lubricant Charge			1.66	1.66	liter	56	56	ounce	1
Refrigerant Charge			6.72	6.35	kg	14.82	14	lb	0.94
Refrigerant Mass Flow Rate			403.6	312.8	kg/hr	890.0	689.6	lb/hr	0.77
Composition, at compr. inlet if applicable				n/a	% wt				
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	79.99	F	
		wb	19.4	19.5	C	66.99	67.02	F	
	Outdoor	db	46.1	46.1	C	115.01	115.01	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity			15199	14816	W	51874	50567	Btu/hr	0.97
Sensible Capacity			12673	11148	W	43253	38047	Btu/hr	0.88
Total System Power Input			6047	5685	W	6047	5685	W	0.94
Compressor Power Input			5227	4866	W	5227	4866	W	0.93
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	8.58	8.90	Btuh/W	1.04
Coeff. Of Performance (COP)			2.51	2.61					n/a
Other System Changes									
System Data*						Base.	Alt.	Ratio	
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.7	50.0	m ³ /min	1756	1765	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	46.1	46.1	C	115	115	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	

* see previous page

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	19.5	1131	22.8	1064	67	164	73	154
Compressor Discharge	88.6	3458	97.2	3260	191	501	207	473
Condenser Inlet	88.6	3458	97.2	3260	191	501	207	473
Condenser Outlet	47.8	3379	47.7	3208	118	490	118	465
Expansion Device Inlet	46.0	3379	45.9	3208	115	490	115	465
Subcooling, at expan. device	8.0		7.9		14		14	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	19.9	1136	21.3	1073	68	165	70	156
Evaporator Superheat	7.8		9.1		15		16	

Data Source(s) for Refrigerant Properties
NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"125F"				
				Alt. Refrig.:	DR-5A				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			DR-5A						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	6.35	kg	14.82	14	lb	0.94	
Refrigerant Mass Flow Rate		406.1	311.6	kg/hr	895.5	687.0	lb/hr	0.77	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	79.99	F	
		wb	19.4	19.5	C	67.00	67.08	F	
	Outdoor	db	51.7	51.7	C	125.06	125.02	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		13773	13410	W	47008	45770	Btu/hr	0.97	
Sensible Capacity		12420	10512	W	42389	35879	Btu/hr	0.85	
Total System Power Input		6663	6347	W	6663	6347	W	0.95	
Compressor Power Input		5227	0	W	5227	0	W	0.00	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	7.05	7.21	Btuh/W	1.02	
Coeff. Of Performance (COP)		2.07	2.11					n/a	
Other System Changes									
System Data*					Base.	Alt.	Ratio		
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	49.8	m ³ /min	1757	1758	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	51.7	51.7	C	125	125	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	

* see previous page

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	20.4	1161	23.3	1080	69	168	74	157
Compressor Discharge	96.6	3837	106.4	3634	206	557	223	527
Condenser Inlet	96.6	3837	106.4	3634	206	557	223	527
Condenser Outlet	53.6	3762	53.8	3582	128	546	129	520
Expansion Device Inlet	51.5	3762	51.7	3582	125	546	125	520
Subcooling, at expan. device	7.3		7.1		13		13	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	20.2	1166	22.2	1082	68	169	72	157
Evaporator Superheat	7.8		9.4		14		17	

Data Source(s) for Refrigerant Properties

NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"B"				
				Alt. Refrig.:	R-32				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			R-32						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	5.00	kg	14.82	11.02	lb	0.74	
Refrigerant Mass Flow Rate		395.0	270.9	kg/hr	871.0	597.4	lb/hr	0.69	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	79.99	F	
		wb	19.5	19.5	C	67.02	67.01	F	
	Outdoor	db	27.8	27.8	C	82.01	82.03	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		20138	19637	W	68731	67022	Btu/hr	0.98	
Sensible Capacity		13463	13376	W	45948	45652	Btu/hr	0.99	
Total System Power Input		4309	4558	W	4309	4558	W	1.06	
Compressor Power Input		3520	3763	W	3520	3763	W	1.07	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	15.95	14.70	Btuh/W	0.92	
Coeff. Of Performance (COP)		4.67	4.31					n/a	
Other System Changes									
System Data*					Base.	Alt.	Ratio		
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	49.8	m ³ /min	1759	1757	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	27.8	27.8	C	82	82	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	16.9	1070	19.8	1083	62	155	68	157
Compressor Discharge	64.4	2347	80.5	2343	148	340	177	340
Condenser Inlet	64.4	2347	80.5	2343	148	340	177	340
Condenser Outlet	30.2	2266	33.8	2281	86	329	93	331
Expansion Device Inlet	29.1	2266	32.6	2281	84	329	91	331
Subcooling, at expan. device	7.8		4.1		14		7	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	17.2	1077	17.5	1090	63	156	64	158
Evaporator Superheat	7.8		8.0		13		14	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"A"				
				Alt. Refrig.:	R-32				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			R-32						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data									
		Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio	
Mode (Heating/Cooling)		Cooling							
Compressor Type		scroll	scroll						
Compressor Displacement		0.229	0.229	m ³ /min			ft ³ /min	1	
Nominal Motor Size		4.5	4.5	hp				1	
Motor Speed		3500	3500	rpm				1	
Expansion Device Type		TXV	TXV						
Lubricant Charge		1.66	1.66	liter	56	56	ounce	1	
Refrigerant Charge		6.72	5.00	kg	14.82	11.02	lb	0.74	
Refrigerant Mass Flow Rate		396.18	271.94	kg/hr	873.6	599.6	lb/hr	0.69	
Composition, at compr. inlet if applicable			n/a	% wt					
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	80.00	F	
		wb	19.5	19.5	C	67.02	67.01	F	
	Outdoor	db	35.0	35.0	C	95.00	95.01	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity		18819	18024	W	64230	61516	Btu/hr	0.96	
Sensible Capacity		12889	12532	W	43989	42771	Btu/hr	0.97	
Total System Power Input		4867	5178	W	4867	5178	W	1.06	
Compressor Power Input		4062	4385	W	4062	4385	W	1.08	
Energy Efficiency Ratio (EER)		n/a	n/a	W/W	13.20	11.88	Btuh/W	0.90	
Coeff. Of Performance (CCOP)		3.87	3.48					n/a	
Other System Changes									
System Data*					Base.	Alt.	Ratio		
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.63	49.89	m ³ /min	1753	1762	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.9	135.9	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	35.0	35.0	C	95.0	95.0	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	17.0	1082	20.9	1107	63	157	70	161
Compressor Discharge	73.0	2744	91.9	2752	163	398	197	399
Condenser Inlet	73.0	2744	91.9	2752	163	398	197	399
Condenser Outlet	37.5	2670	41.2	2696	99	387	106	391
Expansion Device Inlet	35.9	2640	39.9	2696	97	383	104	391
Subcooling, at expan. device	7.9		3.4		14		6	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	18.0	1089	18.1	1113	64	158	65	161
Evaporator Superheat	7.8		7.9		14		14	

Data Source(s) for Refrigerant Properties
NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Test: "115F"
 Alt. Refrig.: R-32

Manufacturer: Lennox Industries Inc. Manufacturer's Notation: LGH060H4ESP

Basic Information	
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)	R-32
Alternative Lubricant Type and ISO Viscosity	3MAF-POE
Baseline Refrigerant and Lubricant	R-410A, 3MAF-POE
Make and Model of System	Lennox, LGH060H4ESP
Nominal Capacity and Type of System	5 Ton, Rooftop Air Conditioning Unit

Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio
Mode (Heating/Cooling)			Cooling						
Compressor Type			scroll	scroll					
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min	1
Nominal Motor Size			4.5	4.5	hp				1
Motor Speed			3500	3500	rpm				1
Expansion Device Type			TXV	TXV					
Lubricant Charge			1.66	1.66	liter	56	56	ounce	1
Refrigerant Charge			6.72	5.00	kg	14.82	11.02	lb	0.74
Refrigerant Mass Flow Rate			403.6	270.3	kg/hr	890.0	595.9	lb/hr	0.67
Composition, at compr. inlet if applicable				n/a	% wt				
Ambient Temps.	Indoor	db	26.7	26.7	C	80.02	80.00	F	
		wb	19.4	19.4	C	66.99	66.99	F	
	Outdoor	db	46.1	46.1	C	115.01	115.00	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity			15199	15132	W	51874	51646	Btu/hr	1.00
Sensible Capacity			12673	11106	W	43253	37906	Btu/hr	0.88
Total System Power Input			6047	6396	W	6047	6396	W	1.06
Compressor Power Input			5227	0	W	5227	0	W	0.00
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	8.58	8.08	Btuh/W	0.94
Coeff. Of Performance (COP)			2.51	2.37					n/a

Other System Changes									

System Data*			Base.	Alt.	Ratio
Degradation Coefficient – Cd					
Seasonal Energy Efficiency Ratio - SEER					
Heating Seasonal Performance Factor - HSPF					

* Only Steady-State Cooling Tests Conducted

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.7	49.9	m ³ /min	1756	1763	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	46.1	46.1	C	115	115	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	

* see previous page

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	19.5	1131	22.8	1144	67	164	73	166
Compressor Discharge	88.6	3458	112.0	3477	191	501	234	504
Condenser Inlet	88.6	3458	112.0	3477	191	501	234	504
Condenser Outlet	47.8	3379	52.3	3422	118	490	126	496
Expansion Device Inlet	46.0	3379	50.6	3422	115	490	123	496
Subcooling, at expan. device	8.0		3.0		14		5	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	19.9	1136	19.1	1146	68	165	66	166
Evaporator Superheat	7.8		7.9		15		14	

Data Source(s) for Refrigerant Properties

NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM				Test:	"125F"				
				Alt. Refrig.:	R-32				
Manufacturer: Lennox Industries Inc.			Manufacturer's Notation: LGH060H4ESP						
Basic Information									
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)			R-32						
Alternative Lubricant Type and ISO Viscosity			3MAF-POE						
Baseline Refrigerant and Lubricant			R-410A, 3MAF-POE						
Make and Model of System			Lennox, LGH060H4ESP						
Nominal Capacity and Type of System			5 Ton, Rooftop Air Conditioning Unit						
Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	Base.	Ratio
Mode (Heating/Cooling)			Cooling						
Compressor Type			scroll	scroll					
Compressor Displacement			0.229	0.229	m ³ /min			ft ³ /min	1
Nominal Motor Size			4.5	4.5	hp				1
Motor Speed			3500	3500	rpm				1
Expansion Device Type			TXV	TXV					
Lubricant Charge			1.66	1.66	liter	56	56	ounce	1
Refrigerant Charge			6.72	5.00	kg	14.82	11.02	lb	0.74
Refrigerant Mass Flow Rate			406.1	270.3	kg/hr	895.5	596.1	lb/hr	0.67
Composition, at compr. inlet if applicable				n/a	% wt				
Ambient Temps.	Indoor	db	26.7	26.7	C	79.99	80.00	F	
		wb	19.4	19.4	C	67.00	67.00	F	
	Outdoor	db	51.7	51.7	C	125.06	125.06	F	
		wb	n/a	n/a	C	n/a	n/a	F	
Total Capacity			13773	13590	W	47008	46384	Btu/hr	0.99
Sensible Capacity			12420	10574	W	42389	36090	Btu/hr	0.85
Total System Power Input			6663	7206	W	6663	7206	W	1.08
Compressor Power Input			5227	0	W	5227	0	W	0.00
Energy Efficiency Ratio (EER)			n/a	n/a	W/W	7.05	6.44	Btuh/W	0.91
Coeff. Of Performance (COP)			2.07	1.89					n/a
Other System Changes									
System Data*						Base.	Alt.	Ratio	
Degradation Coefficient – Cd									
Seasonal Energy Efficiency Ratio - SEER									
Heating Seasonal Performance Factor - HSPF									
* Only Steady-State Cooling Tests Conducted									

Lennox Testing Report

Low-GWP AREP SYSTEM DROP-IN TEST DATA FORM

Type of System: R-410A Single Package AC Unit Alternate Refrigerant: _____

Air Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator							
Heat Exchange Fluid	Air						
Flow Rate (gas)	49.8	50.0	m ³ /min	1757	1765	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature*	*	*	C	*	*	F	
Outlet Temperature*	*	*	C	*	*	F	
Condenser							
Heat Exchange Fluid	Air	Air					
Flow Rate (gas)	135.92	135.92	m ³ /min	4800	4800	ft ³ /min	1.00
Flow Rate (liquid)	n/a	n/a	L/min	n/a	n/a	gal/min	n/a
Inlet Temperature	51.7	51.7	C	125	125	F	
Outlet Temperature	(notmeasured)	(notmeasured)	C	(notmeasured)	(notmeasured)	F	
* see previous page							

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psia]	T [F]	P [psia]
Compressor Suction	20.4	1161	25.8	1185	69	168	78	172
Compressor Discharge	96.6	3837	125.2	3878	206	557	257	562
Condenser Inlet	96.6	3837	125.2	3878	206	557	257	562
Condenser Outlet	53.6	3762	58.2	3825	128	546	137	555
Expansion Device Inlet	51.5	3762	56.6	3825	125	546	134	555
Subcooling, at expan. device	7.3		2.0		13		4	
Evaporator Inlet	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)	(not measured)
Evaporator Outlet	20.2	1166	20.0	1185	68	169	68	172
Evaporator Superheat	7.8		7.6		14		14	

Data Source(s) for Refrigerant Properties
 NIST REFPROP v. 9, and Alt. Refrigerant Manufacturer

Additional Notes

Submitted by: RBU Lennox Industries Inc.