



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

## **TEST REPORT #5**

### **Soft-optimized System Test of Refrigerant R-32 in 3-ton Split System Heat Pump**

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December 19, 2012

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



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## Low-GWP AREP SOFT-OPTIMIZED SYSTEM TEST

### 1. Introduction:

A R410A 3T split system heat pump (SSZ140361BA / AVPTC313714AA) was selected for the system soft-optimization test of R32 in Intertek (1809 10<sup>th</sup> St. Suite 400, Plano, TX 75074) for 10 days. The baseline test of R410A was performed in Goodman psychrometric lab in Houston during which, however, compressor discharge pressure was not measured.

### 2. Details of Test Setup:

#### a. Description of System

The R410A system selected for the soft-optimized system test of R32 is SSZ140361BA (OD, SN 1201157846) and AVPTC313714AA (ID, SN 1110632843). The nominal specification and baseline configuration is

Nominal cooling capacity (btu/hr)	Nominal heating capacity (btu/hr)	OD valve	ID valve	OD fan motor	ID fan motor	R410A charge (oz)	Volts-Hz-phase	Lubrication
36,000	36,000	Piston (0.059")	5T TXV	PSC	ECM	186	208/230-60-1	POE

#### b. Description of Modifications to System

Since latent enthalpy of R32 is 50% more than R410A, the charge of R32 was initially designed at 132 oz (3.74 kg, 70% of R410A charge) to accomplish the same total capacity as R410A. During the test, the charge was further optimized to 131 oz (3.71 kg) to obtain 7-10 °F subcooling.

ID TXV was changed to a 3T TXV and OD piston was changed to 0.049" per the flow rate estimated.

Other components in the system stay the same as R410A system.

#### c. Description of Tests Conducted

Both baseline R410A test in Houston and R32 test in Intertek follow AHRI 210-240 and ASHRAE 37. Unfortunately, since compressor discharge pressure sensor was not installed in the baseline R410A test, there is no compressor discharge pressure data of baseline R410A test.

During cyclic tests of both baseline and R32 tests, the indoor fan ECM motor was turned off and simulation fan was used.

Fig. 1 is the schematic of the test setup with data measurement location marked in the diagram. Table 1 lists the measuring points in the heat pump system.

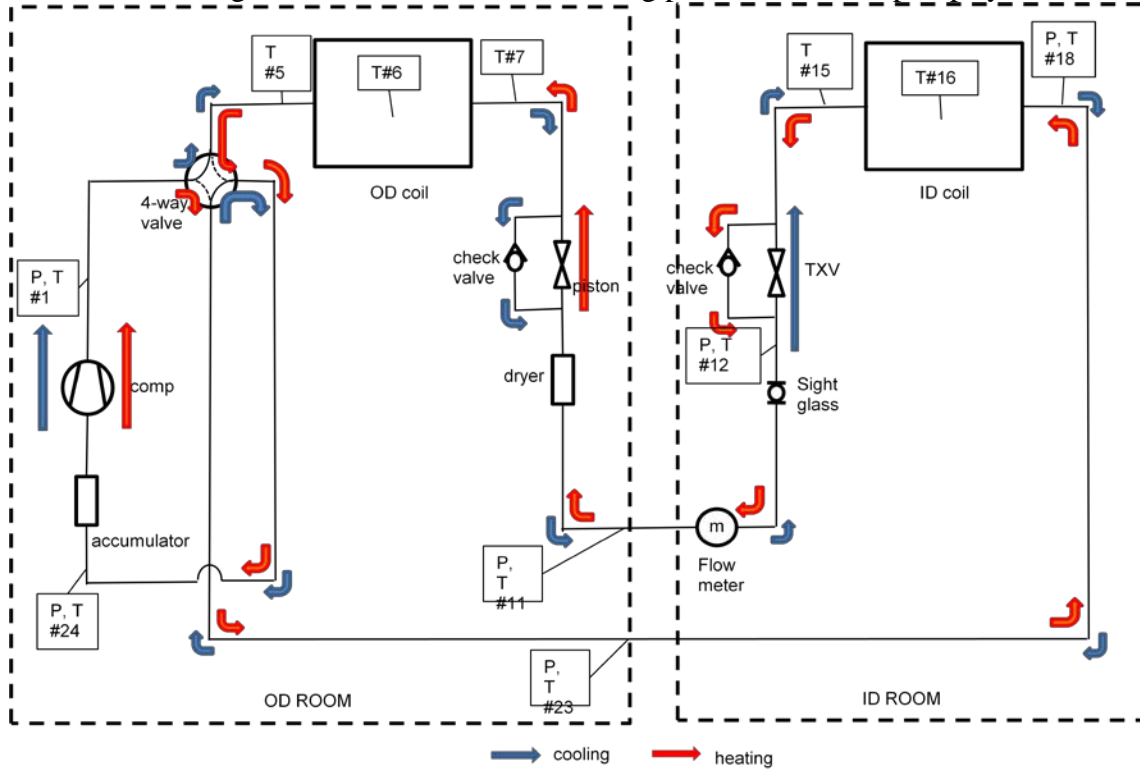


Figure 1 Schematic of soft-optimized system test setup

Table 1 Data measurement location

Data locations	P	T	Ref. flow rate
Comp discharge (#1)	x1	x1	
Comp suction (#24)	x1	x1	
OD coil common in (#5)		x1	
OD coil mid (#6)		x1	
OD coil out (#7)		x1	
After OD piston, liquid @ SV (#11)	x1	x1	
Suction vapor @ SV (#23)	x1	x1	
ID coil in (#15)		x1	
ID coil mid (#16)		x1	
ID coil common out @ TXV bulb (#18)	x1	x1	
Before ID TXV (#12)	x1	x1	x1
Total	x6	x11	x1

### 3. Results and Conclusions

#### a. Data Form

Please see data forms of steady state test A/B/C/H1/H3 in the following pages.  
The R32 properties are based on NIST RefProp 8 in Intertek (Plano, TX)

#### b. Conclusions

- R32 is compatible to the existing R410A system (no change was made to the system except for the size of the orifice and TXV);
- R32 charge is 30% lower than R410A;
- R32 flow rate is 33% lower than R410A for A/B/H1 conditions;
- R32 capacity is 4% higher than R410A at A condition and 2% higher in B condition, EER/COP is 1-2% higher for A/B/H1 conditions (Fig. 2);
- R32 discharge temperature is higher than R410A, the largest change is 15 °F at H1 condition, the highest temperature is 172 °F at A condition (Fig. 3);
- R32 condensing pressure is about 10 psi higher than R410A for A/B/H1/H3 conditions; R32 evaporating pressure is a little higher than R410A;

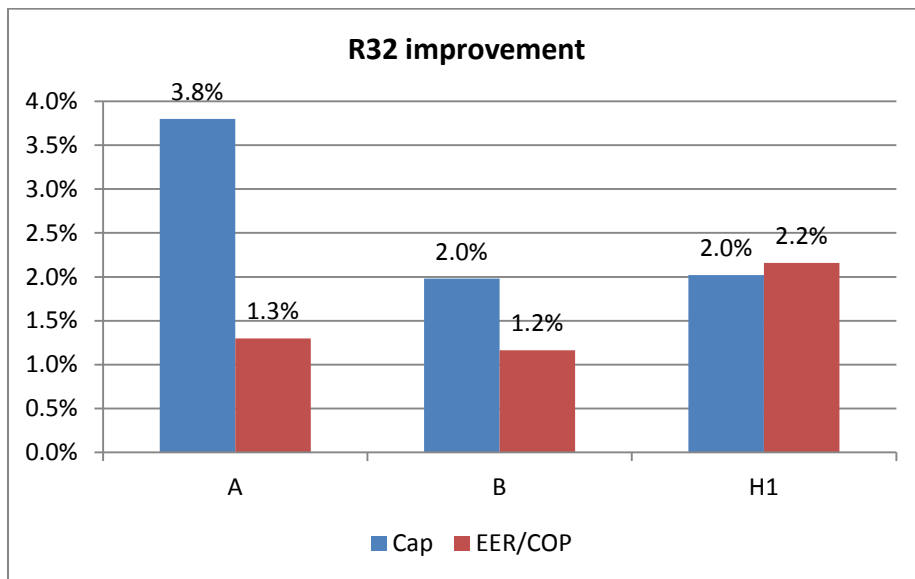


Figure 2 Capacity & EER of R32 improvement over R410A

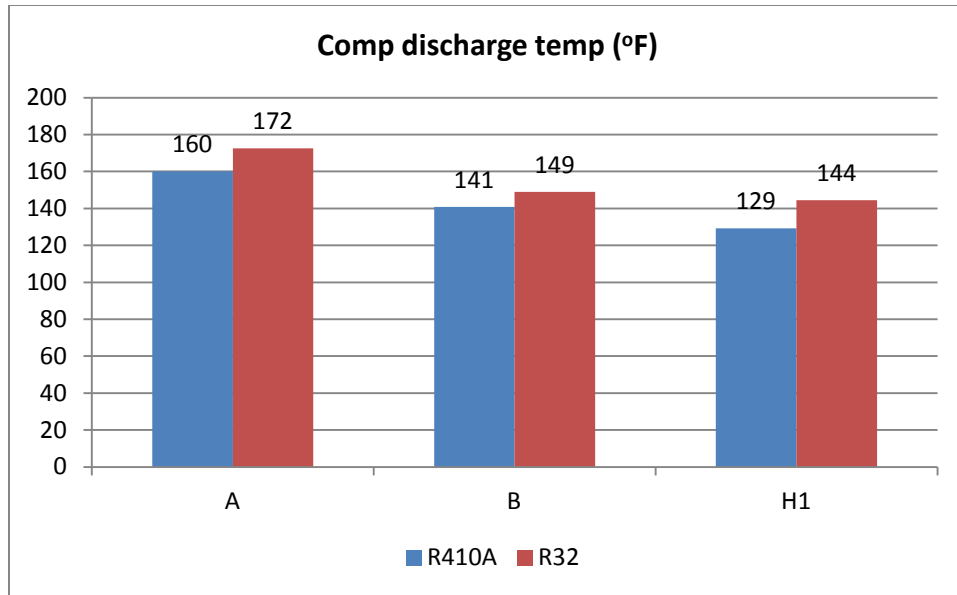


Figure 3 Compressor discharge temperature of R32 vs. R410A

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Manufacturer: Goodman \_\_\_\_\_

Manufacturer's Notation: A test \_\_\_\_\_

<b>Basic Information</b>	
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)	R32
Alternative Lubricant Type and ISO Viscosity	POE
Baseline Refrigerant and Lubricant	R410A & POE
Make and Model of System	SSZ140361BA / AVPTC313714AA
Nominal Capacity and Type of System	36,000 btu/hr (cooling/heating)

<b>Comparison Data</b>		<b>Base.</b>	<b>Alt.</b>	<b>SI Units</b>	<b>Base.</b>	<b>Alt.</b>	<b>IP Units</b>	<b>Ratio</b>	
Mode (Heating/Cooling)		Cool	XXX	XXX	XXX	XXX	XXX	XXX	
Compressor Type		Scroll	Scroll	XXX	XXX	XXX	XXX	XXX	
Compressor Displacement		0.083	0.083	M <sup>3</sup> /min	2.94	2.94	Ft <sup>3</sup> /min		
Nominal Motor Size				hp	XXX	XXX	XXX		
Motor Speed		3500	3500	rpm	XXX	XXX	XXX		
Expansion Device Type		ID 5T TXV OD piston	ID 3T TXV OD piston	XXX	XXX	XXX	XXX	XXX	
Lubricant Charge		0.71	0.71	kg	1.56	1.56	lb		
Refrigerant Charge		5.27	3.71	kg	11.63	8.19	lb	0.70	
Refrigerant Mass Flow Rate		3.94	2.60	kg/min	8.69	5.74	lb/min	0.66	
Composition, at compr. Inlet if applicable		XXX	XXX	% wt	XXX	XXX	XXX	XXX	
Ambient Temps.	In - door	db	26.67	26.67	C	80.00	80.00	F	XXX
		wb	19.44	19.45	C	67.00	67.01	F	XXX
	Out - door	db	35	34.98	C	95.01	94.97	F	XXX
		wb	19.18	19.47	C	66.52	67.04	F	XXX
Total Capacity		10163	10549	W	34679	35996	Btu/hr	1.04	
Sensible Capacity		8439	8143	W	28795	27785	Btu/hr	0.96	
Total System Power Input		2812	2883	W	2812	2883	W	1.03	
OD Unit Power Input		2584	2642	W	2584	2642	W	1.02	
Energy Efficiency Ratio (EER)		3.61	3.66	W/W	12.33	12.49	Btu/hr/W	1.01	
Coeff. Of Performance (COP)		XXX	XXX	XXX	XXX	XXX	XXX		

<b>Other System Changes</b>	

<b>System Data</b>	<b>Base.</b>	<b>Alt.</b>	<b>Ratio</b>
Degradation Coefficient – Cd	0.187	0.122	0.65
Seasonal Energy Efficiency Ratio - SEER	14.02	14.70	1.05

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Type of System: air-source split HP  
(e.g., SSHP, window RAC, chiller, etc.)

Alternate Refrigerant: R32  
(and composition as charged, % weight, if not proprietary)

Air/Water Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)	35.93	35.14	m <sup>3</sup> /min	1269	1241	ft <sup>3</sup> /min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	26.67	26.67	C	80.00	80.00	F	XXXXXX
Outlet Temperature	15.27	15.31	C	59.48	59.55	F	XXXXXX
Condenser	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)			m <sup>3</sup> /min			ft <sup>3</sup> /min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	35.01	34.98	C	95.01	94.97	F	XXXXXX
Outlet Temperature			C			F	XXXXXX

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psig]	T [F]	P [psig]
Compressor Suction	17.34	1016.6	22.18	1052.4	63.22	147.45	71.93	152.64
Compressor Discharge	71.09		78.05	2681.6	159.97		172.49	388.94
Condenser Inlet			75.47				167.85	
Condenser Outlet	40.49	2581.1	40.61	2649.7	104.89	374.35	105.09	384.3
Expansion Device Inlet	39.9	2530.9	39.58	2643.5	103.82	367.07	103.25	383.41
Subcooling, at expan. device	3.66	XXX	4.63	XXX	6.59	XXX	8.33	XXX
Evaporator Inlet			14.55				58.19	
Evaporator Outlet	11.94	1043.8	13.74	1061.9	53.50	151.39	56.74	154.01
Evaporator Superheat	1.03	XXX	2.13	XXX	1.85	XXX	3.83	XXX

Data Source(s) for Refrigerant Properties

Additional Notes

Submitted by: Hao Li

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Manufacturer: Goodman \_\_\_\_\_

Manufacturer's Notation: B test \_\_\_\_\_

<b>Basic Information</b>	
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)	R32
Alternative Lubricant Type and ISO Viscosity	POE
Baseline Refrigerant and Lubricant	R410A & POE
Make and Model of System	SSZ140361BA / AVPTC313714AA
Nominal Capacity and Type of System	36,000 btu/hr (cooling/heating)

Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Mode (Heating/Cooling)			Cool	XXX	XXX	XXX	XXX	XXX	XXX
Compressor Type			Scroll	Scroll	XXX	XXX	XXX	XXX	XXX
Compressor Displacement			0.083	0.083	M <sup>3</sup> /min	2.94	2.94	Ft <sup>3</sup> /min	
Nominal Motor Size					hp	XXX	XXX	XXX	
Motor Speed			3500	3500	rpm	XXX	XXX	XXX	
Expansion Device Type			ID 5T TXV OD piston	ID 3T TXV OD piston	XXX	XXX	XXX	XXX	XXX
Lubricant Charge			0.71	0.71	kg	1.56	1.56	lb	
Refrigerant Charge			5.27	3.71	kg	11.63	8.19	lb	0.70
Refrigerant Mass Flow Rate			3.90	2.64	kg/min	8.59	5.81	lb/min	0.68
Composition, at compr. Inlet if applicable			XXX	XXX	% wt	XXX	XXX	XXX	XXX
Ambient Temps.	In - door	db	26.66	26.67	C	79.99	80.00	F	XXX
		wb	19.44	19.45	C	67.00	67.01	F	XXX
	Out - door	db	27.77	27.78	C	81.98	82.00	F	XXX
		wb	14.74	15.9	C	58.53	60.62	F	XXX
Total Capacity			11051	11269	W	37706	38453	Btu/hr	1.02
Sensible Capacity			8788	8504	W	29985	29017	Btu/hr	0.97
Total System Power Input			2437	2458	W	2437	2458	W	1.01
OD Unit Power Input			2203	2240	W	2203	2240	W	1.02
Energy Efficiency Ratio (EER)			4.53	4.59	W/W	15.47	15.65	Btu/hr/W	1.01
Coeff. Of Performance (COP)			XXX	XXX	XXX	XXX	XXX	XXX	

<b>Other System Changes</b>

System Data	Base.	Alt.	Ratio
Degradation Coefficient – Cd	0.187	0.122	0.65
Seasonal Energy Efficiency Ratio - SEER	14.02	14.70	1.05



## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Type of System: air-source split HP  
(e.g., SSHP, window RAC, chiller, etc.)

Alternate Refrigerant: R32  
(and composition as charged, % weight, if not proprietary)

Air/Water Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)	35.91	35.03	m ^ 3/min	1268	1237	ft ^3/min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	26.67	26.67	C	80.00	80.00	F	XXXXXX
Outlet Temperature	14.82	14.79	C	58.67	58.63	F	XXXXXX
Condenser	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)			m ^ 3/min			ft ^3/min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	27.77	27.78	C	81.98	82.00	F	XXXXXX
Outlet Temperature			C			F	XXXXXX

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psig]	T [F]	P [psig]
Compressor Suction	16.77	994.7	19.26	1031.5	62.19	144.27	66.66	149.61
Compressor Discharge	60.52		64.98	2239.2	140.94		148.96	324.77
Condenser Inlet			62.91				145.24	
Condenser Outlet	32.82	2137.8	33.17	2205.6	91.08	310.06	91.71	319.9
Expansion Device Inlet	32.55	2090.1	32.68	2200.3	90.59	303.15	90.83	319.13
Subcooling, at expan. device	1.82	XXX	4.28	XXX	6.27	XXX	7.7	XXX
Evaporator Inlet			13.98				57.16	
Evaporator Outlet	13.13	1014.6	13.09	1041.5	55.63	147.16	55.57	151.05
Evaporator Superheat	1.85	XXX	2.08	XXX	3.33	XXX	3.74	XXX

Data Source(s) for Refrigerant Properties

Additional Notes

Submitted by: Hao Li

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Manufacturer: Goodman \_\_\_\_\_

Manufacturer's Notation: C test \_\_\_\_\_

<b>Basic Information</b>	
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)	R32
Alternative Lubricant Type and ISO Viscosity	POE
Baseline Refrigerant and Lubricant	R410A & POE
Make and Model of System	SSZ140361BA / AVPTC313714AA
Nominal Capacity and Type of System	36,000 btu/hr (cooling/heating)

Comparison Data			Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Mode (Heating/Cooling)			Cool	XXX	XXX	XXX	XXX	XXX	XXX
Compressor Type			Scroll	Scroll	XXX	XXX	XXX	XXX	XXX
Compressor Displacement			0.083	0.083	M <sup>3</sup> /min	2.94	2.94	Ft <sup>3</sup> /min	
Nominal Motor Size					hp	XXX	XXX	XXX	
Motor Speed			3500	3500	rpm	XXX	XXX	XXX	
Expansion Device Type			ID 5T TXV OD piston	ID 3T TXV OD piston	XXX	XXX	XXX	XXX	XXX
Lubricant Charge			0.71	0.71	kg	1.56	1.56	lb	
Refrigerant Charge			5.27	3.71	kg	11.63	8.19	lb	0.70
Refrigerant Mass Flow Rate			3.63	2.41	kg/min	8.01	5.31	lb/min	0.66
Composition, at compr. Inlet if applicable			XXX	XXX	% wt	XXX	XXX	XXX	XXX
Ambient Temps.	In - door	db	26.69	26.5	C	80.05	79.70	F	XXX
		wb	11.24	13.63	C	52.23	56.53	F	XXX
	Out - door	db	27.81	27.78	C	82.06	82.00	F	XXX
		wb	18.03	15.38	C	64.45	59.69	F	XXX
Total Capacity			9876	10271	W	33698	35045	Btu/hr	1.04
Sensible Capacity			9876	10271	W	33698	35045	Btu/hr	1.04
Total System Power Input			2468	2432	W	2468	2432	W	0.99
Compressor Power Input			2242	2204	W	2242	2204	W	0.98
Energy Efficiency Ratio (EER)			4.00	4.22	W/W	13.65	14.41	Btu/hr/W	1.06
Coeff. Of Performance (COP)			XXX	XXX	XXX	XXX	XXX	XXX	

<b>Other System Changes</b>									

System Data	Base.	Alt.	Ratio
Degradation Coefficient – Cd	0.187	0.122	0.65
Seasonal Energy Efficiency Ratio - SEER	14.02	14.70	1.05

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Type of System: air-source split HP  
(e.g., SSHP, window RAC, chiller, etc.)

Alternate Refrigerant: R32  
(and composition as charged, % weight, if not proprietary)

Air/Water Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)	35.79	34.26	m <sup>3</sup> /min	1264	1210	ft <sup>3</sup> /min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	26.69	26.5	C	80.05	79.7	F	XXXXXX
Outlet Temperature	13.22	11.97	C	55.80	53.55	F	XXXXXX
Condenser	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)			m <sup>3</sup> /min			ft <sup>3</sup> /min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	27.81	27.78	C	82.06	82.00	F	XXXXXX
Outlet Temperature			C			F	XXXXXX

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psig]	T [F]	P [psig]
Compressor Suction	15.65	929.2	17.76	946.6	60.17	134.77	63.97	137.29
Compressor Discharge	63.92		66.34	2190.2	147.06		151.41	317.66
Condenser Inlet			63.91				147.04	
Condenser Outlet	34.23	2199.8	33.08	2160.2	93.61	319.06	91.54	313.31
Expansion Device Inlet	33.79	2158.3	32.55	2156.7	92.82	313.03	90.59	312.8
Subcooling, at expan. device	3.48	XXX	3.64	XXX	6.27	XXX	6.56	XXX
Evaporator Inlet			11.59				52.86	
Evaporator Outlet	10.59	959.4	10.57	955.4	51.06	139.15	51.03	138.57
Evaporator Superheat	2.22	XXX	2.18	XXX	3.99	XXX	3.93	XXX

Data Source(s) for Refrigerant Properties

Additional Notes

Submitted by: Hao Li

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Manufacturer: Goodman \_\_\_\_\_

Manufacturer's Notation: H1 test \_\_\_\_\_

<b>Basic Information</b>	
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)	R32
Alternative Lubricant Type and ISO Viscosity	POE
Baseline Refrigerant and Lubricant	R410A & POE
Make and Model of System	SSZ140361BA / AVPTC313714AA
Nominal Capacity and Type of System	36,000 btu/hr (cooling/heating)

<b>Comparison Data</b>		<b>Base.</b>	<b>Alt.</b>	<b>SI Units</b>	<b>Base.</b>	<b>Alt.</b>	<b>IP Units</b>	<b>Ratio</b>	
Mode (Heating/Cooling)		Cool	XXX	XXX	XXX	XXX	XXX	XXX	
Compressor Type		Scroll	Scroll	XXX	XXX	XXX	XXX	XXX	
Compressor Displacement		0.083	0.083	M <sup>3</sup> /min	2.94	2.94	Ft <sup>3</sup> /min		
Nominal Motor Size				hp	XXX	XXX	XXX		
Motor Speed		3500	3500	rpm	XXX	XXX	XXX		
Expansion Device Type		ID 5T TXV OD piston	ID 3T TXV OD piston	XXX	XXX	XXX	XXX	XXX	
Lubricant Charge		0.71	0.71	kg	1.56	1.56	lb		
Refrigerant Charge		5.27	3.71	kg	11.63	8.19	lb	0.70	
Refrigerant Mass Flow Rate		3.10	1.95	kg/min	6.83	4.30	lb/min	0.63	
Composition, at compr. Inlet if applicable		XXX	XXX	% wt	XXX	XXX	XXX	XXX	
Ambient Temps.	In - door	db	21.09	21.11	C	69.96	69.99	F	XXX
		wb	12.9	12.82	C	55.22	55.08	F	XXX
	Out - door	db	8.31	8.33	C	46.96	46.99	F	XXX
		wb	6.11	6.11	C	42.99	43.00	F	XXX
Total Capacity		9583	9777	W	32699	33359	Btu/hr	1.02	
Sensible Capacity		9583	9777	W	32698	33359	Btu/hr	1.02	
Total System Power Input		2520	2518	W	2520	2518	W	1.0	
Compressor Power Input		2300	2305	W	2300	2305	W	1.0	
Energy Efficiency Ratio (EER)		XXX	XXX	W/W	XXX	XXX	Btu/hr/W		
Coeff. Of Performance (COP)		3.80	3.88	W/W	3.80	3.88	W/W	1.02	

<b>Other System Changes</b>	

<b>System Data</b>	<b>Base.</b>	<b>Alt.</b>	<b>Ratio</b>
Degradation Coefficient – Cd	0.348	0.287	0.82
Heating Seasonal Performance Factor - HSPF	8.46	9.12	1.08

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Type of System: air-source split HP  
(e.g., SSHP, window RAC, chiller, etc.)

Alternate Refrigerant: R32  
(and composition as charged, % weight, if not proprietary)

Air/Water Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)			m ^ 3/min			ft ^3/min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	8.31	8.33	C	46.96	46.99	F	XXXXXX
Outlet Temperature			C			F	XXXXXX
Condenser	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)	36.27	35.23	m ^ 3/min	1281	1244	ft ^3/min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	21.09	21.11	C	69.96	69.99	F	XXXXXX
Outlet Temperature	34.73	35.87	C	94.51	96.56	F	XXXXXX

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psig]	T [F]	P [psig]
Compressor Suction	2.33	72.7	5.07	766.4	36.20	106.27	41.13	111.16
Compressor Discharge	54.06		62.47	2246.6	129.31		144.44	325.84
Condenser Inlet	48.88	2212.3	62.14	2245.3	119.99	320.87	143.86	325.66
Condenser Outlet	28.11	2179.6	31.92		82.59	316.12	89.46	
Expansion Device Inlet	26.31	2141.4	28.59		79.35	310.58	83.47	321.76
Subcooling, at expan. device	10.66	XXX	8.68	XXX	19.19	XXX	15.63	XXX
Evaporator Inlet			3.23				37.81	
Evaporator Outlet	2.33	732.7	2.79	766.4	36.20	106.27	37.03	111.16
Evaporator Superheat	0.87	XXX	0.83	XXX	1.56	XXX	1.49	XXX

Data Source(s) for Refrigerant Properties

Additional Notes

Submitted by: Hao Li

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Manufacturer: Goodman \_\_\_\_\_

Manufacturer's Notation: H3 test \_\_\_\_\_

<b>Basic Information</b>	
Alternative Refrigerant (If not proprietary, composition as Charged, % wt)	R32
Alternative Lubricant Type and ISO Viscosity	POE
Baseline Refrigerant and Lubricant	R410A & POE
Make and Model of System	SSZ140361BA / AVPTC313714AA
Nominal Capacity and Type of System	36,000 btu/hr (cooling/heating)

Comparison Data		Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio	
Mode (Heating/Cooling)		Cool	XXX	XXX	XXX	XXX	XXX	XXX	
Compressor Type		Scroll	Scroll	XXX	XXX	XXX	XXX	XXX	
Compressor Displacement		0.083	0.083	M <sup>3</sup> /min	2.94	2.94	Ft <sup>3</sup> /min		
Nominal Motor Size				hp	XXX	XXX	XXX		
Motor Speed		3500	3500	rpm	XXX	XXX	XXX		
Expansion Device Type		ID 5T TXV OD piston	ID 3T TXV OD piston	XXX	XXX	XXX	XXX	XXX	
Lubricant Charge		0.71	0.71	kg	1.56	1.56	lb		
Refrigerant Charge		5.27	3.71	kg	11.63	8.19	lb	0.70	
Refrigerant Mass Flow Rate		1.74	0.72	kg/min	3.83	1.59	lb/min	0.42	
Composition, at compr. Inlet if applicable		XXX	XXX	% wt	XXX	XXX	XXX	XXX	
Ambient Temps.	In - door	db	21.17	21.11	C	70.10	70.00	F	XXX
		wb	13.49	12.84	C	56.28	55.12	F	XXX
	Out - door	db	-8.34	-8.4	C	16.99	16.88	F	XXX
		wb	-9.46	-9.34	C	14.97	15.19	F	XXX
Total Capacity		5645	6035	W	19262	20592	Btu/hr	1.07	
Sensible Capacity		5645	6035	W	19256	20592	Btu/hr	1.07	
Total System Power Input		2309	2360	W	2309	2360	W	1.02	
Compressor Power Input		2093	2135	W	2093	2135	W	1.02	
Energy Efficiency Ratio (EER)		XXX	XXX	W/W	XXX	XXX	Btu/hr/W		
Coeff. Of Performance (COP)		2.44	2.56	W/W	2.44	2.56	W/W	1.05	

<b>Other System Changes</b>	

System Data	Base.	Alt.	Ratio
Degradation Coefficient – Cd	0.348	0.287	0.82
Heating Seasonal Performance Factor - HSPF	8.46	9.12	1.08

## Low GWP AREP SOFT – OPTIMIZED SYSTEM TEST DATA FORM

Type of System: air-source split HP  
(e.g., SSHP, window RAC, chiller, etc.)

Alternate Refrigerant: R32  
(and composition as charged, % weight, if not proprietary)

Air/Water Side Data	Base.	Alt.	SI Units	Base.	Alt.	IP Units	Ratio
Evaporator	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)			m ^ 3/min			ft ^3/min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	-8.34	-8.4	C	16.99	16.88	F	XXXXXX
Outlet Temperature			C			F	XXXXXX
Condenser	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Heat Exchange Fluid			XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Flow Rate (gas)	36.27	35.11	m ^ 3/min	1281	1240	ft ^3/min	
Flow Rate (liquid)			L/min			gal/min	
Inlet Temperature	21.17	21.11	C	70.01	70.00	F	XXXXXX
Outlet Temperature	29.04	30.08	C	84.27	86.15	F	XXXXXX

Refrigerant Side Data Temperatures & Pressures	Baseline		Alternative		Baseline		Alternative	
	T (C)	P [kPa]	T (C)	P [kPa]	T [F]	P [psig]	T [F]	P [psig]
Compressor Suction	-11.88	422.0	-12.02	443.4	10.62	61.20	10.36	64.31
Compressor Discharge	49.12		48.57	1877.4	120.41		119.43	272.29
Condenser Inlet	38.92	1807.3	46.23	1879.0	102.06	262.13	115.22	272.52
Condenser Outlet	29.22	1783.0	30.44	1861.8	84.60	258.60	86.79	270.03
Expansion Device Inlet	26.55	1761.5	27.23	1849.7	79.79	255.48	81.01	268.28
Subcooling, at expan. device	3.08	XXX	3.19	XXX	5.55	XXX	5.75	XXX
Evaporator Inlet			-10.89				12.39	
Evaporator Outlet	-11.88	422.0	-11.33	443.4	10.62	61.20	11.61	64.31
Evaporator Superheat	0.78	XXX	0.71	XXX	1.40	XXX	1.28	XXX

Data Source(s) for Refrigerant Properties

Additional Notes

Submitted by: Hao Li