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Intertek Performance Evaluation of Heat Pipe Technology's SMART Water-Glycol Pump System

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Introduction

Heat Pipe Technology Inc. (HPT) designs and manufactures several energy recovery products. In 2019, HPT launched the SMART Water-Glycol Pump System which brings our decades of experience in, and knowledge of, best-in-class heat pipe systems into the runaround glycol market. HPT offers a fully designed and engineered system that out-performs the competition by providing greater than 50% effectiveness for a 6-row coil system. With an industry-leading five-year warranty, HPT's system comprises coils and associated sensors as well as a fully engineered pump skid with integrated sensors, a touchscreen interface, and controls.

To demonstrate our best-in-class performance, HPT commissioned Intertek to perform independent testing of our SMART Water-Glycol Pump System according to AHRI Standard 1060. Intertek is the Air-Conditioning, Heating & Refrigeration Institute's (AHRI) testing partner for air-to-air energy recovery certification testing.

Test Setup

A runaround glycol system, manufactured by HPT, was tested at four winter conditions (100% airflow, 80% airflow, 60% airflow and 40% airflow) and three pressure differentials (-5", 0" and 5"). The airflow ratings correspond to 500 SFPM, 400 SFPM, 300 SFPM and 200 SFPM. The conditions were selected so as to provide a graph of AHRI 1060 effectiveness versus coil face velocity for different face velocities; to demonstrate the associated coil air-side pressure drops for varying coil face velocities; and to demonstrate zero cross contamination across AHRI Standard 1060 pressure differential testing range. This performance evaluation was conducted using 41% ethylene-glycol as the working fluid (-10°F freezing point).

The measurement locations for data acquisition are shown in Figure 1 below.

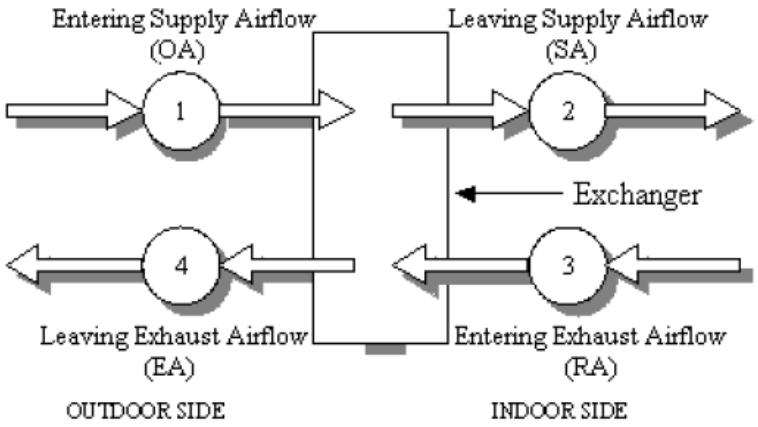

Figure 1: Schematic of Measurement Locations and Nomenclature (courtesy: AHRI 1060 Standard)

Results

The information presented in this section serves to summarize Intertek's testing results of the HPT SMART Water-Glycol Pump system. Table 1 shows a summary of the effectiveness and pressure drop results across the tested range of coil face velocities for this system. The same results are shown graphically in Figures 1 and 2. Table 2 shows the cross contamination (EATR) results across the range of airstream pressure differentials.

Other than rounding to two decimal places where applicable, no other edits have been made to the Intertek data. Raw data from Intertek's testing is attached to the end of this report.

Table 1: Summary of Intertek Effectiveness and Pressure Drop Results

(SFPM)	OA 1 (°F)	SA 2 (°F)	RA 3 (°F)	EA 4 (°F)	ΔP (in w.g.)	Effectiveness
500	36.13	52.93	69.70	55.19	0.64	50.04
400	35.53	54.01	70.19	54.30	0.44	53.32
300	35.11	54.61	69.76	53.97	0.27	56.28
200	34.52	55.07	70.19	54.03	0.13	57.61

Table 2: Summary of Intertek Cross Contamination (EATR) Results

Air Flow	Pressure Differential (in w.g.)	EATR
100% Air Flow	0	0.00
100% Air Flow	-5	0.00
100% Air Flow	5	0.00

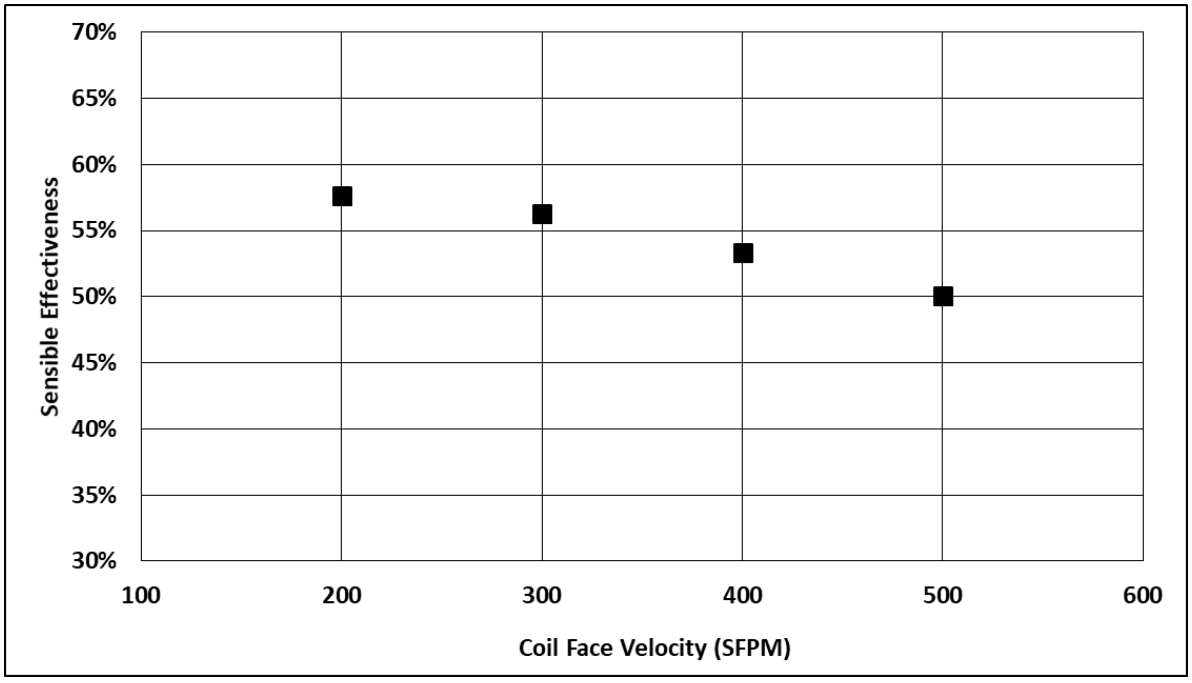

Figure 1: Effectiveness versus Coil Face Velocity for SMART Water-Glycol Pump System

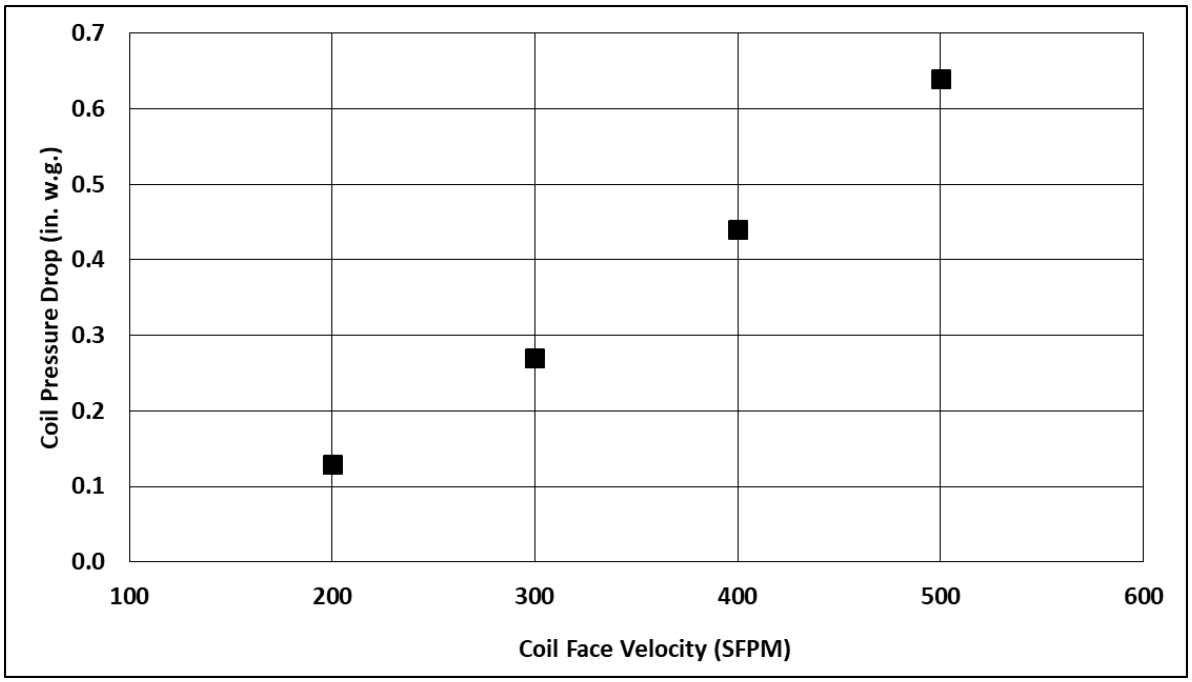

Figure 2: Pressure Drop versus Coil Face Velocity for SMART Water-Glycol Pump System

Conclusions

The results of the Intertek testing demonstrate that runaround glycol systems can be tested to AHRI Standard 1060. Furthermore, the results show that the HPT SMART Water-Glycol Pump System does perform as claimed by HPT with sensible effectiveness greater than 50% for a 6 row system.

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Energy Recovery Ventilators (Air to Air) Effectiveness Test

AHRI 1060-2018
ASHRAE 84-2013, ASHRAE 37-2009

Rev V1.1
4/29/19

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001 G104075023	Test Duration:	30 minutes		Ratings:
Test Type:	Private Testing	Unit Type:	Heat Pipe	Sensible:	[%]
Test parameter:	Recirculating 20 gpm of 41% Ethelyne Glycol	Test Type:	WINTER	Latent:	[%]
Manufacturer:	Heat Pipe Technologies	Condensing:	FALSE	Total:	[%]
Model Number:	HPT SMART GLYCOL 01	Hose Size:	24	Net Sensible:	[%]
Serial Number:	N/A			Net Latent:	[%]
Technician:	Nick Comfort	Facility No.:	CRTHVAC18	Net Total:	[%]
Date:	10/29/19 10:39 AM			Air Flow Sup/Ex:	4167 / 4167 [SCFM]

TEST DATA

G104075023_CRTHVAC18_7391

	1		2		3		4		
Barometer	29.05		29.05		29.05		29.05		[in Hg]
Dry Bulb	36.13		52.93		69.70		55.19		[°F]
Wet Bulb	33.17		42.33		58.05		51.71		[°F]
Nozzle Temperature	35.62		53.80		69.63		55.09		[°F]
Nozzle Diff Pressure	1.61		1.69		1.74		1.70		[in H2O]
Before Nozzle Pressure	5.55		-1.54		4.88		-1.43		[in H2O]
Nozzle A [Lg/Sm]	0.5017	0.501	0.4985	0.5027	0.5005	0.4985	0.502	0.5007	[in]
Nozzle B [Lg/Sm]	0	0	0	0	0	0	0	0	[in]
Nozzle C [Lg/Sm]	7.0035	0	6.9948	0	6.9975	0	6.9988	0	[in]
Nozzle D [Lg/Sm]	9.9975	0	9.9985	0	9.9935	0	9.9973	0	[in]

CALCULATIONS

	1	2	3	4	
Nozzle Specific Volume (v'n)	12.70807767	13.41226739	13.64023761	13.47539297	[ft^3/lbm]
Nozzle Humidity Ratio (W)	0.003409939	0.003465235	0.007921526	0.007584468	[lbmwv/lbma]
Specific Heat of Air	0.24	0.24	0.24	0.24	[Btu/lbm °F]
Total Enthalpy	12.34352589	16.46201897	25.378088	21.47917747	[Btu/lbm]
Volumetric Air Flow	3993.76917	4199.747609	4289.948007	4214.383711	[CFM]
Standard Volumetric Air Flow	4176.028344	4160.613693	4160.467263	4138.566214	[SCFM]
Mass Air Flow	18856.20756	18787.64039	18870.41031	18764.79767	[lb/hr]

TEST RESULTS

	Value	% of Rating	
Leaving Supply Airflow (2)	4160.613693	99.8467409	[SCFM]
Entering Exhaust Airflow (3)	4160.467263	99.84322686	[SCFM]
Net Supply Air Flow	4160.613693	99.8467409	[SCFM]
Sensible Effectiveness	50.05488902		[%]
Latent Effectiveness	1.225646536		[%]
Total Effectiveness	31.59671223		[%]
Net Sensible Effectiveness	49.87287353		[%]
Net Latent Effectiveness	1.221189695		[%]
Net Total Effectiveness	31.48181653		[%]

STABILITY

			Value	Status	
Supply Inlet Dry Bulb (1)	Equ.	7	0.021881696	*	[-]
Exhaust Inlet Dry Bulb (3)	Equ.	8	0.009992856	GOOD	[-]
Supply Humidity Ratio (1)	Equ.	9	0.040848538	GOOD	[-]
Exhaust Humidity Ratio (3)	Equ.	10	0.027228914	GOOD	[-]
Dry Air Flow Mass	Equ.	11	0.009237266	GOOD	[-]
Water Vapor Mass (No Condensate)	Equ.	12	0.07471792	GOOD	[-]
Energy Exchange (No Condensate)	Equ.	13	0.002798786	GOOD	[-]
Sensible Energy Flow Rate	Equ.	14	0.053127877	GOOD	[-]
Water Vapor Mass (Condensate)	Equ.	15			[-]
Energy Exchange (Condensate)	Equ.	16			[-]

NOTES

Winter @ 4167 scfm
* Test ran at 36 degrees due to facility limitations

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	Nick Comfort	10/29/19 10:39 AM	Serial Number1:	N/A

30 MINUTE TEST DATA G104075023_CRTHVAC18_7391

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	29.04	29.06	0.02	29.05	[in Hg]
Dry Bulb 1	35.87	36.86	0.99	36.13	[°F]
Wet Bulb 1	32.95	33.99	1.05	33.17	[°F]
Dry Bulb 2	52.78	53.23	0.45	52.93	[°F]
Wet Bulb 2	42.13	42.94	0.81	42.33	[°F]
Dry Bulb 3	69.44	70.04	0.59	69.70	[°F]
Wet Bulb 3	57.88	58.28	0.40	58.05	[°F]
Dry Bulb 4	55.01	55.61	0.59	55.19	[°F]
Wet Bulb 4	51.58	51.87	0.29	51.71	[°F]
Nozzle Temperature 1	35.37	36.72	1.35	35.62	[°F]
Nozzle Diff Pressure 1	1.56	1.66	0.10	1.61	[in H2O]
Before Nozzle Pressure 1	5.40	5.74	0.35	5.55	[in H2O]
Nozzle Temperature 2	53.64	54.31	0.67	53.80	[°F]
Nozzle Diff Pressure 2	1.62	1.75	0.13	1.69	[in H2O]
Before Nozzle Pressure 2	-1.79	-1.13	0.66	-1.54	[in H2O]
Nozzle Temperature 3	69.35	69.99	0.65	69.63	[°F]
Nozzle Diff Pressure 3	1.67	1.79	0.13	1.74	[in H2O]
Before Nozzle Pressure 3	4.43	5.24	0.81	4.88	[in H2O]
Nozzle Temperature 4	54.91	55.55	0.65	55.09	[°F]
Nozzle Diff Pressure 4	1.62	1.76	0.13	1.70	[in H2O]
Before Nozzle Pressure 4	-1.78	-1.01	0.77	-1.43	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Mass Flow 1	18,518.50	19,074.80	556.30	18,812.97	[lb/hr]
Mass Flow 2	18,346.91	19,045.69	698.77	18,746.30	[lb/hr]
Mass Flow 3	18,347.71	19,047.65	699.94	18,747.03	[lb/hr]
Mass Flow 4	18,252.82	18,969.66	716.85	18,646.83	[lb/hr]
1 to atm	1.33	1.38	0.05	1.36	[in H2O]
1 to 2 Delta P	0.60	0.68	0.09	0.64	[in H2O]
2 to atm	0.69	0.75	0.06	0.72	[in H2O]
2 to 3 Delta P	-0.34	0.42	0.75	0.00	[in H2O]
3 to atm	0.70	0.74	0.04	0.72	[in H2O]
3 to 4 Delta P	0.63	0.71	0.07	0.67	[in H2O]
4 to atm	0.03	0.07	0.05	0.05	[in H2O]
4 to 1 Delta P	0.30	1.01	0.71	0.64	[in H2O]
Relative Humidity 1	72.83	77.47	4.63	74.48	[%]
Relative Humidity 2	39.08	42.20	3.12	39.95	[%]
Relative Humidity 3	49.58	50.32	0.73	49.98	[%]
Relative Humidity 4	78.11	81.17	3.06	79.77	[%]
Air Flow 1	4,115.36	4,238.99	123.63	4,180.80	[SCFM]
Air Flow 2	4,077.23	4,232.52	155.29	4,165.98	[SCFM]
Air Flow 3	4,077.40	4,232.95	155.55	4,166.15	[SCFM]
Air Flow 4	4,056.32	4,215.62	159.30	4,143.88	[SCFM]
Room Ambient	61.94	63.02	1.08	62.37	[°F]

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	Nick Comfort	10/29/19 10:39 AM	Serial Number1:	N/A

30 MINUTE EQUILIBRIUM DATA G104075023_CRTHVAC18_7391

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	29.06	29.06	0.01	29.06	[in Hg]
Dry Bulb 1	36.40	39.29	2.90	37.86	[°F]
Wet Bulb 1	33.22	35.44	2.22	34.32	[°F]
Dry Bulb 2	53.16	54.60	1.44	53.92	[°F]
Wet Bulb 2	42.38	43.64	1.26	42.99	[°F]
Dry Bulb 3	69.52	69.82	0.31	69.68	[°F]
Wet Bulb 3	57.13	58.33	1.20	57.91	[°F]
Dry Bulb 4	55.55	56.87	1.31	56.36	[°F]
Wet Bulb 4	51.19	52.39	1.21	51.85	[°F]
Nozzle Temperature 1	35.95	39.08	3.13	37.33	[°F]
Nozzle Diff Pressure 1	1.57	1.67	0.10	1.62	[in H2O]
Before Nozzle Pressure 1	5.44	5.76	0.32	5.59	[in H2O]
Nozzle Temperature 2	54.20	56.05	1.85	55.06	[°F]
Nozzle Diff Pressure 2	1.64	1.75	0.11	1.70	[in H2O]
Before Nozzle Pressure 2	-1.76	-1.23	0.53	-1.53	[in H2O]
Nozzle Temperature 3	69.35	69.69	0.34	69.55	[°F]
Nozzle Diff Pressure 3	1.67	1.80	0.13	1.74	[in H2O]
Before Nozzle Pressure 3	4.49	5.19	0.69	4.87	[in H2O]
Nozzle Temperature 4	55.54	57.33	1.80	56.37	[°F]
Nozzle Diff Pressure 4	1.63	1.75	0.12	1.69	[in H2O]
Before Nozzle Pressure 4	-1.70	-1.07	0.63	-1.43	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Mass Flow 1	18,565.17	19,093.42	528.25	18,816.58	[lb/hr]
Mass Flow 2	18,442.47	19,022.08	579.61	18,758.92	[lb/hr]
Mass Flow 3	18,356.43	19,078.84	722.41	18,740.10	[lb/hr]
Mass Flow 4	18,264.22	18,940.03	675.81	18,624.12	[lb/hr]
1 to atm	1.34	1.38	0.05	1.36	[in H2O]
1 to 2 Delta P	0.60	0.68	0.08	0.64	[in H2O]
2 to atm	0.69	0.74	0.05	0.71	[in H2O]
2 to 3 Delta P	-0.33	0.35	0.68	0.00	[in H2O]
3 to atm	0.70	0.74	0.04	0.72	[in H2O]
3 to 4 Delta P	0.63	0.70	0.07	0.67	[in H2O]
4 to atm	0.03	0.07	0.04	0.05	[in H2O]
4 to 1 Delta P	0.33	0.99	0.66	0.64	[in H2O]
Relative Humidity 1	68.26	75.93	7.67	70.93	[%]
Relative Humidity 2	37.70	41.94	4.25	39.39	[%]
Relative Humidity 3	47.08	51.08	4.01	49.50	[%]
Relative Humidity 4	68.79	78.11	9.32	74.59	[%]
Air Flow 1	4,125.73	4,243.12	117.39	4,181.60	[SCFM]
Air Flow 2	4,098.46	4,227.27	128.81	4,168.79	[SCFM]
Air Flow 3	4,079.34	4,239.88	160.54	4,164.60	[SCFM]
Air Flow 4	4,058.85	4,209.04	150.18	4,138.83	[SCFM]
Room Ambient	62.30	64.10	1.80	63.18	[°F]

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Energy Recovery Ventilators (Air to Air) Effectiveness Test

AHRI 1060-2018
ASHRAE 84-2013, ASHRAE 37-2009

Rev V1.1
4/29/19

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001 G104075023	Test Duration:	30 minutes		Ratings:
Test Type:	Private Testing	Unit Type:	Heat Pipe	Sensible:	[%]
Test Parameter:	Recirculating 20 gpm of 41% Ethelyne Glycol	Test Type:	WINTER	Latent:	[%]
Manufacturer:	Heat Pipe Technologies	Condensing:	FALSE	Total:	[%]
Model Number:	HPT SMART GLYCOL 01	Hose Size:	24	Net Sensible:	[%]
Serial Number:	N/A			Net Latent:	[%]
Technician:	Nick Comfort	Facility No.:	CRTHVAC18	Net Total:	[%]
Date:	10/30/19 10:01 AM			Air Flow Sup/Ex:	3333 / 3333 [SCFM]

TEST DATA

G104075023_CRTHVAC18_7402

	1		2		3		4		
Barometer	29.09		29.09		29.09		29.09		[in Hg]
Dry Bulb	35.53		54.01		70.19		54.30		[°F]
Wet Bulb	33.40		43.35		57.79		51.06		[°F]
Nozzle Temperature	34.25		54.92		70.06		54.54		[°F]
Nozzle Diff Pressure	1.03		1.08		1.12		1.08		[in H2O]
Before Nozzle Pressure	3.62		-0.92		3.19		-0.92		[in H2O]
Nozzle A [Lg/Sm]	0.5017	0.501	0.4985	0.5027	0.5005	0.4985	0.502	0.5007	[in]
Nozzle B [Lg/Sm]	0	0	0	0	0	0	0	0	[in]
Nozzle C [Lg/Sm]	7.0035	0	6.9948	0	6.9975	0	6.9988	0	[in]
Nozzle D [Lg/Sm]	9.9975	0	9.9985	0	9.9935	0	9.9973	0	[in]

CALCULATIONS

	1	2	3	4	
Nozzle Specific Volume (v'n)	12.71741365	13.402249	13.68674973	13.42253644	[ft^3/lbm]
Nozzle Humidity Ratio (W)	0.003631769	0.003680519	0.007638363	0.007428332	[lbmwv/lbma]
Specific Heat of Air	0.24	0.24	0.24	0.24	[Btu/lbm °F]
Total Enthalpy	12.43774605	16.95530319	25.18720055	21.09193802	[Btu/lbm]
Volumetric Air Flow	3182.699264	3353.981555	3438.156389	3357.6142	[CFM]
Standard Volumetric Air Flow	3324.766448	3324.499173	3323.98721	3310.707231	[SCFM]
Mass Air Flow	15015.78553	15015.30775	15072.19664	15008.85119	[lb/hr]

TEST RESULTS

	Value	% of Rating	
Leaving Supply Airflow (2)	3324.499173	99.74494969	[SCFM]
Entering Exhaust Airflow (3)	3323.98721	99.72958926	[SCFM]
Net Supply Air Flow	3324.499173	99.74494969	[SCFM]
Sensible Effectiveness	53.31832792		[%]
Latent Effectiveness	1.216757622		[%]
Total Effectiveness	35.43333673		[%]
Net Sensible Effectiveness	53.31663141		[%]
Net Latent Effectiveness	1.216718907		[%]
Net Total Effectiveness	35.43220929		[%]

STABILITY

			Value	Status	
Supply Inlet Dry Bulb (1)	Equ.	7	0.004122891	GOOD	[-]
Exhaust Inlet Dry Bulb (3)	Equ.	8	0.018348668	GOOD	[-]
Supply Humidity Ratio (1)	Equ.	9	0.021118754	GOOD	[-]
Exhaust Humidity Ratio (3)	Equ.	10	0.022721125	GOOD	[-]
Dry Air Flow Mass	Equ.	11	0.004250409	GOOD	[-]
Water Vapor Mass (No Condensate)	Equ.	12	0.048301276	GOOD	[-]
Energy Exchange (No Condensate)	Equ.	13	0.024894543	GOOD	[-]
Sensible Energy Flow Rate	Equ.	14	0.066326611	GOOD	[-]
Water Vapor Mass (Condensate)	Equ.	15			[-]
Energy Exchange (Condensate)	Equ.	16			[-]

NOTES

Winter @ 3333 scfm

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	Nick Comfort	10/30/19 10:01 AM	Serial Number1:	N/A

30 MINUTE TEST DATA G104075023_CRTHVAC18_7402

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	29.09	29.10	0.01	29.09	[in Hg]
Dry Bulb 1	35.39	35.66	0.27	35.53	[°F]
Wet Bulb 1	33.22	33.61	0.40	33.40	[°F]
Dry Bulb 2	53.70	54.20	0.50	54.01	[°F]
Wet Bulb 2	43.23	43.52	0.29	43.35	[°F]
Dry Bulb 3	69.55	70.43	0.88	70.19	[°F]
Wet Bulb 3	57.53	57.96	0.43	57.79	[°F]
Dry Bulb 4	54.22	54.37	0.14	54.30	[°F]
Wet Bulb 4	50.86	51.20	0.34	51.06	[°F]
Nozzle Temperature 1	34.07	34.58	0.50	34.25	[°F]
Nozzle Diff Pressure 1	1.00	1.06	0.06	1.03	[in H2O]
Before Nozzle Pressure 1	3.51	3.72	0.21	3.62	[in H2O]
Nozzle Temperature 2	54.76	55.04	0.29	54.92	[°F]
Nozzle Diff Pressure 2	1.04	1.12	0.08	1.08	[in H2O]
Before Nozzle Pressure 2	-1.07	-0.77	0.30	-0.92	[in H2O]
Nozzle Temperature 3	69.37	70.37	1.01	70.06	[°F]
Nozzle Diff Pressure 3	1.07	1.14	0.07	1.12	[in H2O]
Before Nozzle Pressure 3	3.00	3.32	0.32	3.19	[in H2O]
Nozzle Temperature 4	54.38	54.67	0.29	54.54	[°F]
Nozzle Diff Pressure 4	1.05	1.12	0.08	1.08	[in H2O]
Before Nozzle Pressure 4	-1.05	-0.76	0.29	-0.92	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Mass Flow 1	14,781.61	15,240.48	458.88	14,996.77	[lb/hr]
Mass Flow 2	14,698.43	15,220.82	522.39	14,998.14	[lb/hr]
Mass Flow 3	14,704.80	15,187.67	482.87	14,997.12	[lb/hr]
Mass Flow 4	14,692.07	15,204.93	512.86	14,935.63	[lb/hr]
1 to atm	0.94	0.95	0.01	0.94	[in H2O]
1 to 2 Delta P	0.40	0.47	0.07	0.44	[in H2O]
2 to atm	0.50	0.51	0.01	0.51	[in H2O]
2 to 3 Delta P	-0.16	0.13	0.29	0.00	[in H2O]
3 to atm	0.50	0.51	0.01	0.50	[in H2O]
3 to 4 Delta P	0.43	0.48	0.04	0.46	[in H2O]
4 to atm	0.05	0.05	0.01	0.05	[in H2O]
4 to 1 Delta P	0.28	0.57	0.29	0.44	[in H2O]
Relative Humidity 1	80.29	82.51	2.23	81.30	[%]
Relative Humidity 2	39.81	42.10	2.29	40.83	[%]
Relative Humidity 3	46.47	48.50	2.03	47.50	[%]
Relative Humidity 4	80.04	81.52	1.47	80.86	[%]
Air Flow 1	3,284.91	3,386.89	101.98	3,332.73	[SCFM]
Air Flow 2	3,266.43	3,382.52	116.09	3,333.03	[SCFM]
Air Flow 3	3,267.84	3,375.15	107.31	3,332.80	[SCFM]
Air Flow 4	3,265.01	3,378.99	113.97	3,319.14	[SCFM]
Room Ambient	63.20	64.10	0.90	63.65	[°F]

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	Nick Comfort	10/30/19 10:01 AM	Serial Number1:	N/A

30 MINUTE EQUILIBRIUM DATA G104075023_CRTHVAC18_7402

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	29.09	29.10	0.01	29.10	[in Hg]
Dry Bulb 1	34.40	37.08	2.68	36.14	[°F]
Wet Bulb 1	31.99	35.11	3.12	33.76	[°F]
Dry Bulb 2	51.34	53.70	2.36	52.90	[°F]
Wet Bulb 2	41.74	44.04	2.30	43.42	[°F]
Dry Bulb 3	65.18	69.55	4.37	67.84	[°F]
Wet Bulb 3	52.17	57.53	5.36	56.26	[°F]
Dry Bulb 4	50.86	54.24	3.38	53.45	[°F]
Wet Bulb 4	45.63	50.86	5.24	49.63	[°F]
Nozzle Temperature 1	34.23	35.39	1.15	34.73	[°F]
Nozzle Diff Pressure 1	0.99	1.06	0.07	1.03	[in H2O]
Before Nozzle Pressure 1	3.50	3.79	0.29	3.64	[in H2O]
Nozzle Temperature 2	54.11	54.77	0.67	54.59	[°F]
Nozzle Diff Pressure 2	1.05	1.12	0.07	1.08	[in H2O]
Before Nozzle Pressure 2	-1.17	-0.73	0.44	-0.92	[in H2O]
Nozzle Temperature 3	65.59	69.37	3.78	67.79	[°F]
Nozzle Diff Pressure 3	1.06	1.14	0.08	1.11	[in H2O]
Before Nozzle Pressure 3	2.96	3.34	0.38	3.18	[in H2O]
Nozzle Temperature 4	53.86	54.38	0.52	54.25	[°F]
Nozzle Diff Pressure 4	1.03	1.12	0.09	1.08	[in H2O]
Before Nozzle Pressure 4	-1.08	-0.68	0.41	-0.92	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Mass Flow 1	14,707.89	15,223.44	515.54	15,005.37	[lb/hr]
Mass Flow 2	14,737.55	15,258.88	521.33	15,003.26	[lb/hr]
Mass Flow 3	14,714.39	15,217.46	503.07	14,992.39	[lb/hr]
Mass Flow 4	14,581.50	15,164.61	583.12	14,914.50	[lb/hr]
1 to atm	0.93	0.95	0.02	0.94	[in H2O]
1 to 2 Delta P	0.40	0.47	0.07	0.44	[in H2O]
2 to atm	0.49	0.51	0.02	0.50	[in H2O]
2 to 3 Delta P	-0.27	0.17	0.44	0.00	[in H2O]
3 to atm	0.49	0.51	0.01	0.50	[in H2O]
3 to 4 Delta P	0.43	0.48	0.05	0.45	[in H2O]
4 to atm	0.04	0.05	0.01	0.05	[in H2O]
4 to 1 Delta P	0.18	0.60	0.42	0.44	[in H2O]
Relative Humidity 1	62.77	83.96	21.20	79.42	[%]
Relative Humidity 2	41.71	51.76	10.05	45.73	[%]
Relative Humidity 3	41.16	51.20	10.04	48.92	[%]
Relative Humidity 4	67.68	80.14	12.46	77.19	[%]
Air Flow 1	3,268.53	3,383.10	114.57	3,334.64	[SCFM]
Air Flow 2	3,275.12	3,390.98	115.86	3,334.17	[SCFM]
Air Flow 3	3,269.97	3,381.77	111.80	3,331.75	[SCFM]
Air Flow 4	3,240.44	3,370.03	129.59	3,314.44	[SCFM]
Room Ambient	62.66	64.10	1.44	63.38	[°F]

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Energy Recovery Ventilators (Air to Air) Effectiveness Test

AHRI 1060-2018

ASHRAE 84-2013, ASHRAE 37-2009

Rev V1.1
4/29/19

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001 G104075023	Test Duration:	30 minutes		Ratings:
Test Type:	Private Testing	Unit Type:	Heat Pipe	Sensible:	[%]
Test Parameter:	Recirculating 20 gpm of 41% Ethelyne Glycol	Test Type:	WINTER	Latent:	[%]
Manufacturer:	Heat Pipe Technologies	Condensing:	FALSE	Total:	[%]
Model Number:	HPT SMART GLYCOL 01	Hose Size:	24	Net Sensible:	[%]
Serial Number:	N/A			Net Latent:	[%]
Technician:	Nick Comfort	Facility No.:	CRTHVAC18	Net Total:	[%]
Date:	10/31/19 10:02 AM			Air Flow Sup/Ex:	2500 / 2500 [SCFM]

TEST DATA

G104075023_CRTHVAC18_7414

	1		2		3		4		
Barometer	28.64		28.64		28.64		28.64		[in Hg]
Dry Bulb	35.11		54.61		69.76		53.97		[°F]
Wet Bulb	33.34		43.78		58.20		51.59		[°F]
Nozzle Temperature	32.63		55.85		69.67		54.42		[°F]
Nozzle Diff Pressure	1.30		1.37		1.42		1.37		[in H2O]
Before Nozzle Pressure	2.88		-0.46		2.68		-0.54		[in H2O]
Nozzle A [Lg/Sm]	0.5017	0.501	0.4985	0.5027	0.5005	0.4985	0.502	0.5007	[in]
Nozzle B [Lg/Sm]	0	0	0	0	0	0	0	0	[in]
Nozzle C [Lg/Sm]	0	0	0	0	0	0	0	0	[in]
Nozzle D [Lg/Sm]	9.9975	0	9.9985	0	9.9935	0	9.9973	0	[in]

CALCULATIONS

	1	2	3	4	
Nozzle Specific Volume (v'n)	12.90225294	13.62754711	13.91654918	13.62537261	[ft^3/lbm]
Nozzle Humidity Ratio (W)	0.00376445	0.003841708	0.008158578	0.007921705	[lbmwv/lbma]
Specific Heat of Air	0.24	0.24	0.24	0.24	[Btu/lbm °F]
Total Enthalpy	12.48018932	17.27674675	25.65166092	21.54713821	[Btu/lbm]
Volumetric Air Flow	2426.425295	2561.631394	2626.667061	2556.532776	[CFM]
Standard Volumetric Air Flow	2498.091255	2496.734979	2496.222862	2482.075092	[SCFM]
Mass Air Flow	11283.72838	11278.47017	11324.6482	11257.81812	[lb/hr]

TEST RESULTS

	Value	% of Rating	
Leaving Supply Airflow (2)	2496.734979	99.86939914	[SCFM]
Entering Exhaust Airflow (3)	2496.222862	99.84891447	[SCFM]
Net Supply Air Flow	2496.734979	99.86939914	[SCFM]
Sensible Effectiveness	56.28331897		[%]
Latent Effectiveness	1.758207148		[%]
Total Effectiveness	36.41626064		[%]
Net Sensible Effectiveness	56.257091		[%]
Net Latent Effectiveness	1.757387825		[%]
Net Total Effectiveness	36.3992907		[%]

STABILITY

			Value	Status	
Supply Inlet Dry Bulb (1)	Equ.	7	0.004232002	GOOD	[-]
Exhaust Inlet Dry Bulb (3)	Equ.	8	0.003993556	GOOD	[-]
Supply Humidity Ratio (1)	Equ.	9	0.014960618	GOOD	[-]
Exhaust Humidity Ratio (3)	Equ.	10	0.024391716	GOOD	[-]
Dry Air Flow Mass	Equ.	11	0.006388695	GOOD	[-]
Water Vapor Mass (No Condensate)	Equ.	12	0.047604855	GOOD	[-]
Energy Exchange (No Condensate)	Equ.	13	0.041110198	GOOD	[-]
Sensible Energy Flow Rate	Equ.	14	0.095395062	GOOD	[-]
Water Vapor Mass (Condensate)	Equ.	15			[-]
Energy Exchange (Condensate)	Equ.	16			[-]

NOTES

Winter @ 2500 scfm

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	Nick Comfort	10/31/19 10:02 AM	Serial Number1:	N/A

30 MINUTE TEST DATA G104075023_CRTHVAC18_7414

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	28.63	28.64	0.01	28.64	[in Hg]
Dry Bulb 1	35.04	35.26	0.22	35.11	[°F]
Wet Bulb 1	33.18	33.49	0.31	33.34	[°F]
Dry Bulb 2	54.54	54.69	0.14	54.61	[°F]
Wet Bulb 2	43.59	43.93	0.34	43.78	[°F]
Dry Bulb 3	69.62	69.86	0.23	69.76	[°F]
Wet Bulb 3	58.06	58.32	0.25	58.20	[°F]
Dry Bulb 4	53.93	54.02	0.09	53.97	[°F]
Wet Bulb 4	51.44	51.71	0.27	51.59	[°F]
Nozzle Temperature 1	32.43	33.05	0.61	32.63	[°F]
Nozzle Diff Pressure 1	1.26	1.34	0.08	1.30	[in H2O]
Before Nozzle Pressure 1	2.80	2.98	0.17	2.88	[in H2O]
Nozzle Temperature 2	55.80	55.98	0.18	55.85	[°F]
Nozzle Diff Pressure 2	1.34	1.41	0.06	1.37	[in H2O]
Before Nozzle Pressure 2	-0.54	-0.37	0.16	-0.46	[in H2O]
Nozzle Temperature 3	69.51	69.76	0.25	69.67	[°F]
Nozzle Diff Pressure 3	1.38	1.45	0.07	1.42	[in H2O]
Before Nozzle Pressure 3	2.56	2.77	0.21	2.68	[in H2O]
Nozzle Temperature 4	54.35	54.55	0.20	54.42	[°F]
Nozzle Diff Pressure 4	1.32	1.40	0.08	1.37	[in H2O]
Before Nozzle Pressure 4	-0.61	-0.42	0.19	-0.54	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Mass Flow 1	11,085.84	11,442.33	356.49	11,253.29	[lb/hr]
Mass Flow 2	11,129.20	11,390.47	261.27	11,249.19	[lb/hr]
Mass Flow 3	11,097.67	11,394.04	296.36	11,247.54	[lb/hr]
Mass Flow 4	10,993.13	11,323.00	329.87	11,182.90	[lb/hr]
1 to atm	0.60	0.61	0.01	0.61	[in H2O]
1 to 2 Delta P	0.25	0.29	0.04	0.27	[in H2O]
2 to atm	0.33	0.34	0.01	0.33	[in H2O]
2 to 3 Delta P	-0.10	0.12	0.22	0.00	[in H2O]
3 to atm	0.33	0.34	0.01	0.33	[in H2O]
3 to 4 Delta P	0.27	0.30	0.03	0.28	[in H2O]
4 to atm	0.04	0.06	0.01	0.05	[in H2O]
4 to 1 Delta P	0.17	0.40	0.23	0.27	[in H2O]
Relative Humidity 1	83.08	85.15	2.07	84.29	[%]
Relative Humidity 2	39.91	41.80	1.89	41.01	[%]
Relative Humidity 3	50.30	50.86	0.56	50.61	[%]
Relative Humidity 4	84.95	86.42	1.47	85.81	[%]
Air Flow 1	2,463.60	2,542.82	79.22	2,500.81	[SCFM]
Air Flow 2	2,473.24	2,531.30	58.06	2,499.90	[SCFM]
Air Flow 3	2,466.23	2,532.09	65.86	2,499.54	[SCFM]
Air Flow 4	2,443.00	2,516.31	73.31	2,485.17	[SCFM]
Room Ambient	65.00	66.62	1.62	65.69	[°F]

Energy Recovery Ventilators (Air to Air) Effectiveness Test
AHRI 1060-2018
ASHRAE 84-2013, ASHRAE 37-2009

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	Nick Comfort	10/31/19 10:02 AM	Serial Number1:	N/A

30 MINUTE EQUILIBRIUM DATA G104075023_CRTHVAC18_7414

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	28.64	28.65	0.01	28.65	[in Hg]
Dry Bulb 1	34.94	35.10	0.16	35.05	[°F]
Wet Bulb 1	32.41	33.27	0.87	33.05	[°F]
Dry Bulb 2	54.62	55.03	0.41	54.79	[°F]
Wet Bulb 2	43.39	43.84	0.45	43.76	[°F]
Dry Bulb 3	69.71	70.20	0.49	69.95	[°F]
Wet Bulb 3	58.01	58.15	0.14	58.09	[°F]
Dry Bulb 4	53.95	54.22	0.27	54.10	[°F]
Wet Bulb 4	51.31	51.49	0.18	51.44	[°F]
Nozzle Temperature 1	32.36	32.58	0.22	32.44	[°F]
Nozzle Diff Pressure 1	1.26	1.34	0.08	1.30	[in H2O]
Before Nozzle Pressure 1	2.79	2.96	0.17	2.87	[in H2O]
Nozzle Temperature 2	55.98	56.63	0.65	56.27	[°F]
Nozzle Diff Pressure 2	1.33	1.41	0.08	1.37	[in H2O]
Before Nozzle Pressure 2	-0.56	-0.38	0.18	-0.47	[in H2O]
Nozzle Temperature 3	69.56	70.07	0.50	69.83	[°F]
Nozzle Diff Pressure 3	1.37	1.46	0.10	1.42	[in H2O]
Before Nozzle Pressure 3	2.56	2.80	0.24	2.68	[in H2O]
Nozzle Temperature 4	54.55	55.21	0.67	54.84	[°F]
Nozzle Diff Pressure 4	1.32	1.41	0.09	1.37	[in H2O]
Before Nozzle Pressure 4	-0.64	-0.42	0.22	-0.54	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Mass Flow 1	11,081.39	11,422.47	341.08	11,256.98	[lb/hr]
Mass Flow 2	11,056.14	11,386.97	330.84	11,248.84	[lb/hr]
Mass Flow 3	11,045.60	11,425.90	380.30	11,249.55	[lb/hr]
Mass Flow 4	11,006.28	11,351.21	344.93	11,184.27	[lb/hr]
1 to atm	0.60	0.61	0.01	0.61	[in H2O]
1 to 2 Delta P	0.25	0.29	0.05	0.27	[in H2O]
2 to atm	0.33	0.34	0.01	0.33	[in H2O]
2 to 3 Delta P	-0.11	0.11	0.22	0.00	[in H2O]
3 to atm	0.33	0.34	0.01	0.33	[in H2O]
3 to 4 Delta P	0.27	0.30	0.03	0.28	[in H2O]
4 to atm	0.05	0.05	0.01	0.05	[in H2O]
4 to 1 Delta P	0.16	0.38	0.22	0.27	[in H2O]
Relative Humidity 1	77.67	84.16	6.48	82.40	[%]
Relative Humidity 2	37.52	41.19	3.67	40.24	[%]
Relative Humidity 3	48.60	50.31	1.70	49.61	[%]
Relative Humidity 4	82.84	85.05	2.21	84.21	[%]
Air Flow 1	2,462.61	2,538.41	75.80	2,501.63	[SCFM]
Air Flow 2	2,457.00	2,530.52	73.52	2,499.83	[SCFM]
Air Flow 3	2,454.66	2,539.17	84.51	2,499.98	[SCFM]
Air Flow 4	2,445.92	2,522.58	76.65	2,485.48	[SCFM]
Room Ambient	65.54	67.52	1.98	66.65	[°F]

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Energy Recovery Ventilators (Air to Air) Effectiveness Test

AHRI 1060-2018

ASHRAE 84-2013, ASHRAE 37-2009

Rev V1.1
4/29/19

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001 G104075023	Test Duration:	30 minutes		Ratings:
Test Type:	Private Testing	Unit Type:	Heat Pipe	Sensible:	[%]
Test Parameter:	Recirculating 20 gpm of 41% Ethelyne Glycol	Test Type:	WINTER	Latent:	[%]
Manufacturer:	Heat Pipe Technologies	Condensing:	FALSE	Total:	[%]
Model Number:	HPT SMART GLYCOL 01	Hose Size:	24	Net Sensible:	[%]
Serial Number:	N/A			Net Latent:	[%]
Technician:	Nick Comfort	Facility No.:	CRTHVAC18	Net Total:	[%]
Date:	11/1/19 10:23 AM			Air Flow Sup/Ex:	1667 / 1667 [SCFM]

TEST DATA

G104075023_CRTHVAC18_7435

	1		2		3		4		
Barometer	28.82		28.82		28.82		28.82		[in Hg]
Dry Bulb	34.52		55.07		70.19		54.03		[°F]
Wet Bulb	33.20		44.29		58.02		51.14		[°F]
Nozzle Temperature	31.29		56.63		70.14		54.73		[°F]
Nozzle Diff Pressure	0.57		0.61		0.63		0.61		[in H2O]
Before Nozzle Pressure	1.34		-0.17		1.25		-0.24		[in H2O]
Nozzle A [Lg/Sm]	0.5017	0.501	0.4985	0.5027	0.5005	0.4985	0.502	0.5007	[in]
Nozzle B [Lg/Sm]	0	0	0	0	0	0	0	0	[in]
Nozzle C [Lg/Sm]	0	0	0	0	0	0	0	0	[in]
Nozzle D [Lg/Sm]	9.9975	0	9.9985	0	9.9935	0	9.9973	0	[in]

CALCULATIONS

	1	2	3	4	
Nozzle Specific Volume (v'n)	12.83680281	13.55243171	13.88975527	13.53472835	[ft^3/lbm]
Nozzle Humidity Ratio (W)	0.003819336	0.003937818	0.007882403	0.007611981	[lbmwv/lbma]
Specific Heat of Air	0.24	0.24	0.24	0.24	[Btu/lbm °F]
Total Enthalpy	12.39607906	17.49012947	25.4549675	21.22580147	[Btu/lbm]
Volumetric Air Flow	1602.920029	1695.165726	1743.93026	1697.22275	[CFM]
Standard Volumetric Air Flow	1658.586648	1661.218878	1660.976139	1659.337449	[SCFM]
Mass Air Flow	7492.146068	7504.922051	7533.3088	7523.857322	[lb/hr]

TEST RESULTS

	Value	% of Rating	
Leaving Supply Airflow (2)	1661.218878	99.65320204	[SCFM]
Entering Exhaust Airflow (3)	1660.976139	99.63864058	[SCFM]
Net Supply Air Flow	1661.218878	99.65320204	[SCFM]
Sensible Effectiveness	57.594753		[%]
Latent Effectiveness	2.916071181		[%]
Total Effectiveness	39.00830023		[%]
Net Sensible Effectiveness	57.69296646		[%]
Net Latent Effectiveness	2.921043812		[%]
Net Total Effectiveness	39.07481914		[%]

STABILITY

			Value	Status	
Supply Inlet Dry Bulb (1)	Equ.	7	0.006534816	GOOD	[-]
Exhaust Inlet Dry Bulb (3)	Equ.	8	0.00436477	GOOD	[-]
Supply Humidity Ratio (1)	Equ.	9	0.019520746	GOOD	[-]
Exhaust Humidity Ratio (3)	Equ.	10	0.080897672	GOOD	[-]
Dry Air Flow Mass	Equ.	11	0.000443732	GOOD	[-]
Water Vapor Mass (No Condensate)	Equ.	12	0.038471933	GOOD	[-]
Energy Exchange (No Condensate)	Equ.	13	0.064683695	GOOD	[-]
Sensible Energy Flow Rate	Equ.	14	0.121048498	GOOD	[-]
Water Vapor Mass (Condensate)	Equ.	15			[-]
Energy Exchange (Condensate)	Equ.	16			[-]

NOTES

Winter @ 1667 scfm

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	Nick Comfort	11/1/19 10:23 AM	Serial Number1:	N/A

30 MINUTE TEST DATA G104075023_CRTHVAC18_7435

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	28.81	28.83	0.02	28.82	[in Hg]
Dry Bulb 1	34.29	34.68	0.40	34.52	[°F]
Wet Bulb 1	32.89	33.43	0.54	33.20	[°F]
Dry Bulb 2	55.00	55.10	0.11	55.07	[°F]
Wet Bulb 2	44.00	44.51	0.50	44.29	[°F]
Dry Bulb 3	70.04	70.31	0.27	70.19	[°F]
Wet Bulb 3	57.56	58.50	0.93	58.02	[°F]
Dry Bulb 4	53.74	54.29	0.56	54.03	[°F]
Wet Bulb 4	50.83	51.42	0.59	51.14	[°F]
Nozzle Temperature 1	31.16	31.43	0.27	31.29	[°F]
Nozzle Diff Pressure 1	0.56	0.59	0.04	0.57	[in H2O]
Before Nozzle Pressure 1	1.29	1.38	0.09	1.34	[in H2O]
Nozzle Temperature 2	56.54	56.75	0.22	56.63	[°F]
Nozzle Diff Pressure 2	0.59	0.62	0.03	0.61	[in H2O]
Before Nozzle Pressure 2	-0.20	-0.13	0.07	-0.17	[in H2O]
Nozzle Temperature 3	69.99	70.26	0.27	70.14	[°F]
Nozzle Diff Pressure 3	0.61	0.64	0.03	0.63	[in H2O]
Before Nozzle Pressure 3	1.20	1.30	0.09	1.25	[in H2O]
Nozzle Temperature 4	54.58	54.94	0.36	54.73	[°F]
Nozzle Diff Pressure 4	0.59	0.63	0.03	0.61	[in H2O]
Before Nozzle Pressure 4	-0.28	-0.17	0.11	-0.24	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Mass Flow 1	7,397.20	7,625.73	228.53	7,489.07	[lb/hr]
Mass Flow 2	7,422.07	7,598.62	176.54	7,502.65	[lb/hr]
Mass Flow 3	7,407.67	7,595.68	188.02	7,502.11	[lb/hr]
Mass Flow 4	7,388.43	7,596.26	207.83	7,493.77	[lb/hr]
1 to atm	0.32	0.33	0.01	0.33	[in H2O]
1 to 2 Delta P	0.12	0.15	0.03	0.13	[in H2O]
2 to atm	0.19	0.20	0.01	0.19	[in H2O]
2 to 3 Delta P	-0.03	0.04	0.07	0.00	[in H2O]
3 to atm	0.19	0.20	0.01	0.19	[in H2O]
3 to 4 Delta P	0.13	0.15	0.02	0.14	[in H2O]
4 to atm	0.05	0.05	0.01	0.05	[in H2O]
4 to 1 Delta P	0.10	0.17	0.07	0.14	[in H2O]
Relative Humidity 1	87.18	89.06	1.88	88.10	[%]
Relative Humidity 2	40.18	42.51	2.33	41.60	[%]
Relative Humidity 3	47.08	50.15	3.07	48.51	[%]
Relative Humidity 4	81.90	83.81	1.91	82.85	[%]
Air Flow 1	1,643.88	1,694.66	50.79	1,664.29	[SCFM]
Air Flow 2	1,649.40	1,688.64	39.23	1,667.31	[SCFM]
Air Flow 3	1,646.20	1,687.99	41.78	1,667.19	[SCFM]
Air Flow 4	1,641.93	1,688.11	46.19	1,665.34	[SCFM]
Room Ambient	63.92	65.72	1.80	64.77	[°F]

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	Nick Comfort	11/1/19 10:23 AM	Serial Number1:	N/A

30 MINUTE EQUILIBRIUM DATA G104075023_CRTHVAC18_7435

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	28.79	28.81	0.02	28.80	[in Hg]
Dry Bulb 1	34.56	34.83	0.27	34.69	[°F]
Wet Bulb 1	32.98	33.45	0.47	33.21	[°F]
Dry Bulb 2	54.74	55.00	0.25	54.89	[°F]
Wet Bulb 2	44.02	44.42	0.40	44.23	[°F]
Dry Bulb 3	69.57	70.11	0.54	69.81	[°F]
Wet Bulb 3	57.33	58.42	1.10	57.86	[°F]
Dry Bulb 4	53.95	54.78	0.83	54.25	[°F]
Wet Bulb 4	50.63	51.46	0.83	51.00	[°F]
Nozzle Temperature 1	31.26	31.70	0.43	31.41	[°F]
Nozzle Diff Pressure 1	0.56	0.59	0.03	0.57	[in H2O]
Before Nozzle Pressure 1	1.28	1.39	0.11	1.34	[in H2O]
Nozzle Temperature 2	56.72	57.46	0.74	57.01	[°F]
Nozzle Diff Pressure 2	0.59	0.62	0.03	0.61	[in H2O]
Before Nozzle Pressure 2	-0.21	-0.13	0.08	-0.17	[in H2O]
Nozzle Temperature 3	69.42	70.07	0.65	69.69	[°F]
Nozzle Diff Pressure 3	0.61	0.65	0.04	0.63	[in H2O]
Before Nozzle Pressure 3	1.20	1.29	0.09	1.25	[in H2O]
Nozzle Temperature 4	54.94	55.84	0.90	55.26	[°F]
Nozzle Diff Pressure 4	0.59	0.63	0.04	0.61	[in H2O]
Before Nozzle Pressure 4	-0.28	-0.19	0.09	-0.24	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Mass Flow 1	7,392.45	7,600.15	207.70	7,489.71	[lb/hr]
Mass Flow 2	7,408.11	7,594.65	186.54	7,501.46	[lb/hr]
Mass Flow 3	7,403.16	7,629.45	226.29	7,499.74	[lb/hr]
Mass Flow 4	7,353.22	7,610.76	257.54	7,485.63	[lb/hr]
1 to atm	0.32	0.33	0.01	0.33	[in H2O]
1 to 2 Delta P	0.12	0.15	0.03	0.13	[in H2O]
2 to atm	0.19	0.19	0.01	0.19	[in H2O]
2 to 3 Delta P	-0.03	0.03	0.07	0.00	[in H2O]
3 to atm	0.19	0.19	0.01	0.19	[in H2O]
3 to 4 Delta P	0.13	0.15	0.02	0.14	[in H2O]
4 to atm	0.05	0.05	0.01	0.05	[in H2O]
4 to 1 Delta P	0.09	0.17	0.08	0.14	[in H2O]
Relative Humidity 1	84.81	88.14	3.33	86.65	[%]
Relative Humidity 2	40.92	43.03	2.12	41.98	[%]
Relative Humidity 3	47.65	50.67	3.02	49.07	[%]
Relative Humidity 4	79.24	82.72	3.48	80.82	[%]
Air Flow 1	1,642.82	1,688.98	46.16	1,664.43	[SCFM]
Air Flow 2	1,646.30	1,687.76	41.45	1,667.05	[SCFM]
Air Flow 3	1,645.20	1,695.49	50.29	1,666.66	[SCFM]
Air Flow 4	1,634.10	1,691.34	57.23	1,663.53	[SCFM]
Room Ambient	63.74	65.00	1.26	64.44	[°F]

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Energy Recovery Ventilators (Air to Air) Tracer Gas Test

AHRI 1060-2018
ASHRAE 84-2013, ASHRAE 37-2009

Rev V1.1
4/29/19

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001 G104075023			Ratings:	
Test Type:	Private Testing	Unit Type:	Heat Pipe	EATR:	[%]
Test Parameter:	Recirculating 20 gpm of 41% Ethelyne Glycol	Test Type:	TRACER @ 0.0 " Delta	OACF:	[-]
Manufacturer:	Heat Pipe Technologies			Static: 0.00	[in H2O]
Model Number:	HPT SMART GLYCOL 01	Hose Size:	24	Purge: N/A	[°]
Serial Number:	N/A				
Technician:	R Shephard	Facility No.:	CRTHVAC18		
Date:	11/1/19 7:09 PM			Air Flow Sup/Ex: 4167 4167	[SCFM]

TEST DATA

G104075023_CRTHVAC18_7437

	1		2		3		4		
Barometer	29.05		29.05		29.05		29.05		[in Hg]
Dry Bulb	72.17		72.57		72.62		72.45		[°F]
Wet Bulb	53.52		53.72		53.15		53.11		[°F]
Nozzle Temperature	72.07		72.36		72.58		72.34		[°F]
Nozzle Diff Pressure	1.21		1.22		1.20		1.20		[in H2O]
Before Nozzle Pressure	6.02		-1.61		4.33		-1.47		[in H2O]
Nozzle A [Lg/Sm]	0.5017	0.501	0.4985	0.5027	0.5005	0.4985	0.502	0.5007	[in]
Nozzle B [Lg/Sm]	5.5098	0	5.5046	0	5.4974	0	5.5036	0	[in]
Nozzle C [Lg/Sm]	7.0035	0	6.9948	0	6.9975	0	6.9988	0	[in]
Nozzle D [Lg/Sm]	9.9975	0	9.9985	0	9.9935	0	9.9973	0	[in]
Tracer Reading 1	0.141682106		0.065085218		21.24742424		21.76165058		[ppm]
Tracer Reading 2	0.146359297		0.067569647		21.2831344		21.854497		[ppm]
Tracer Reading 3	0.143652833		0.066384583		21.47954029		21.81521582		[ppm]
Tracer Reading 4	0.144546229		0.0676222		21.46882724		22.19731456		[ppm]
Tracer Reading 5	0.146819134		0.076930598		21.6563056		22.06518696		[ppm]
Tracer Reading 6	0.14771253		0.065317763		21.40097793		21.70272881		[ppm]
Average Tracer Reading	0.145128688		0.068151668		21.42270162		21.89943229		[ppm]

CALCULATIONS

	1	2	3	4	
Nozzle Specific Volume (v'n)	13.64030349	13.91229558	13.70868409	13.90433145	[ft^3/lbm]
Nozzle Humidity Ratio (W)	0.004721361	0.004746592	0.004415558	0.004434215	[lbmwv/lbma]
Volumetric Air Flow	4312.017909	4356.142338	4292.76673	4328.274315	[CFM]
Standard Volumetric Air Flow	4195.170573	4155.138084	4156.873671	4132.205428	[SCFM]
Mass Air Flow	18967.39869	18786.87372	18788.52865	18677.37833	[lb/hr]
Relative Humidity	27.48767734	27.25973725	25.33166409	25.58593452	[%]

TEST RESULTS

	Value	% of Rating	
EATR 1	-0.362919665		[%]
EATR 2	-0.372760982		[%]
EATR 3	-0.362151561		[%]
EATR 4	-0.360734457		[%]
EATR 5	-0.32491959		[%]
EATR 6	-0.387680504		[%]
Average EATR	0.00 *		[%]
OACF	1.009609101		[-]

STABILITY

			Value	Status	
Air Flow Mass Inequality	Equ.	17	0.015524115	GOOD	[-]
Tracer Gas Mass Inequality	Equ.	18	0.012633584	GOOD	[-]

NOTES

Tracer 0.00

* Negative EATR values indicate no transfer of gas.

Energy Recovery Ventilators (Air to Air) Tracer Gas Test
AHRI 1060-2018
ASHRAE 84-2013, ASHRAE 37-2009

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	R Shephard	11/1/19 7:09 PM	Serial Number1:	N/A

DATA STATISTICS G104075023_CRTHVAC18_7437

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	29.04	29.05	0.01	29.05	[in Hg]
Dry Bulb 1	72.13	72.22	0.09	72.17	[°F]
Wet Bulb 1	53.49	53.56	0.07	53.52	[°F]
Dry Bulb 2	72.56	72.57	0.02	72.57	[°F]
Wet Bulb 2	53.70	53.77	0.07	53.72	[°F]
Dry Bulb 3	72.59	72.66	0.07	72.62	[°F]
Wet Bulb 3	53.09	53.21	0.13	53.15	[°F]
Dry Bulb 4	72.43	72.47	0.04	72.45	[°F]
Wet Bulb 4	53.06	53.17	0.11	53.11	[°F]
Nozzle Temperature 1	72.02	72.14	0.13	72.07	[°F]
Nozzle Diff Pressure 1	1.18	1.25	0.07	1.21	[in H2O]
Before Nozzle Pressure 1	5.84	6.17	0.33	6.02	[in H2O]
Nozzle Temperature 2	72.34	72.38	0.04	72.36	[°F]
Nozzle Diff Pressure 2	1.18	1.26	0.08	1.22	[in H2O]
Before Nozzle Pressure 2	-1.92	-1.32	0.60	-1.61	[in H2O]
Nozzle Temperature 3	72.55	72.62	0.07	72.58	[°F]
Nozzle Diff Pressure 3	1.15	1.25	0.10	1.20	[in H2O]
Before Nozzle Pressure 3	3.94	4.65	0.71	4.33	[in H2O]
Nozzle Temperature 4	72.32	72.36	0.04	72.34	[°F]
Nozzle Diff Pressure 4	1.16	1.24	0.09	1.20	[in H2O]
Before Nozzle Pressure 4	-1.75	-1.10	0.66	-1.47	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Mass Flow 1	18,649.53	19,206.78	557.25	18,932.95	[lb/hr]
Mass Flow 2	18,445.38	19,082.45	637.07	18,753.26	[lb/hr]
Mass Flow 3	18,344.35	19,100.47	756.12	18,760.89	[lb/hr]
Mass Flow 4	18,289.14	18,952.82	663.69	18,650.43	[lb/hr]
1 to atm	1.40	1.43	0.03	1.41	[in H2O]
1 to 2 Delta P	0.63	0.74	0.11	0.68	[in H2O]
2 to atm	0.71	0.74	0.03	0.73	[in H2O]
2 to 3 Delta P	-0.38	0.35	0.73	0.00	[in H2O]
3 to atm	0.72	0.75	0.03	0.73	[in H2O]
3 to 4 Delta P	0.64	0.72	0.08	0.68	[in H2O]
4 to atm	0.04	0.07	0.03	0.05	[in H2O]
4 to 1 Delta P	0.28	1.04	0.76	0.68	[in H2O]
Relative Humidity 1	27.47	27.72	0.25	27.59	[%]
Relative Humidity 2	27.28	27.51	0.23	27.36	[%]
Relative Humidity 3	25.31	25.59	0.28	25.44	[%]
Relative Humidity 4	25.56	25.83	0.27	25.69	[%]
Air Flow Rate 1	4,144.48	4,268.32	123.84	4,207.46	[SCFM]
Air Flow Rate 2	4,099.11	4,240.69	141.58	4,167.53	[SCFM]
Air Flow Rate 3	4,076.66	4,244.69	168.03	4,169.23	[SCFM]
Air Flow Rate 4	4,064.39	4,211.88	147.49	4,144.68	[SCFM]
Room Ambient	68.60	69.32	0.72	68.94	[°F]

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Energy Recovery Ventilators (Air to Air) Tracer Gas Test

AHRI 1060-2018

ASHRAE 84-2013, ASHRAE 37-2009

Rev V1.1
4/29/19

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001 G104075023			Ratings:	
Test Type:	Private Testing	Unit Type:	Heat Pipe	EATR:	[%]
Test Parameter:	Recirculating 20 gpm of 41% Ethelyne Glycol	Test Type:	TRACER -5.0" Delta	OACF:	[-]
Manufacturer:	Heat Pipe Technologies			Static: -5.0	[in H2O]
Model Number:	HPT SMART GLYCOL 01	Hose Size:	24	Purge: N/A	[°]
Serial Number:	N/A				
Technician:	R Shephard	Facility No.:	CRTHVAC18		
Date:	11/1/19 9:49 PM			Air Flow Sup/Ex: 4167 4167	[SCFM]

TEST DATA

G104075023_CRTHVAC18_7438

	1		2		3		4		
Barometer	29.06		29.06		29.06		29.06		[in Hg]
Dry Bulb	70.32		71.54		72.34		71.45		[°F]
Wet Bulb	52.24		52.74		52.66		52.31		[°F]
Nozzle Temperature	70.17		71.40		72.29		71.37		[°F]
Nozzle Diff Pressure	1.19		1.23		1.20		1.20		[in H2O]
Before Nozzle Pressure	1.99		-7.25		4.32		-1.45		[in H2O]
Nozzle A [Lg/Sm]	0.5017	0.501	0.4985	0.5027	0.5005	0.4985	0.502	0.5007	[in]
Nozzle B [Lg/Sm]	5.5098	0	5.5046	0	5.4974	0	5.5036	0	[in]
Nozzle C [Lg/Sm]	7.0035	0	6.9948	0	6.9975	0	6.9988	0	[in]
Nozzle D [Lg/Sm]	9.9975	0	9.9985	0	9.9935	0	9.9973	0	[in]
Tracer Reading 1	0.140512808		0.062962088		21.55810265		21.62952298		[ppm]
Tracer Reading 2	0.13617721		0.059188804		21.66701865		21.79378972		[ppm]
Tracer Reading 3	0.139159576		0.062939753		21.81343031		22.56691475		[ppm]
Tracer Reading 4	0.146254192		0.075665392		21.66166212		22.39729147		[ppm]
Tracer Reading 5	0.142010561		0.072062904		21.80450277		22.21338413		[ppm]
Tracer Reading 6	0.146359297		0.071551829		21.54917511		22.11518119		[ppm]
Average Tracer Reading	0.141745607		0.067395128		21.6756486		22.11934737		[ppm]

CALCULATIONS

	1	2	3	4	
Nozzle Specific Volume (v'n)	13.71964535	14.07886326	13.69249503	13.86901496	[ft^3/lbm]
Nozzle Humidity Ratio (W)	0.004436936	0.004431819	0.004205803	0.004219829	[lbmwv/lbma]
Volumetric Air Flow	4289.176579	4406.965868	4285.451146	4310.689411	[CFM]
Standard Volumetric Air Flow	4149.990505	4155.185056	4155.563915	4126.77756	[SCFM]
Mass Air Flow	18757.81686	18781.20038	18778.68629	18648.86334	[lb/hr]
Relative Humidity	27.52924562	26.38005614	24.37614352	25.2063185	[%]

TEST RESULTS

	Value	% of Rating	
EATR 1	-0.362088923		[%]
EATR 2	-0.357572678		[%]
EATR 3	-0.351660381		[%]
EATR 4	-0.328084879		[%]
EATR 5	-0.322897552		[%]
EATR 6	-0.349521622		[%]
Average EATR	0.00 *		[%]
OACF	0.998754951		[-]

STABILITY

			Value	Status	
Air Flow Mass Inequality	Equ.	17	0.005674404	GOOD	[-]
Tracer Gas Mass Inequality	Equ.	18	0.010069602	GOOD	[-]

NOTES

Tracer -5.00

* Negative EATR values indicate no transfer of gas.

Energy Recovery Ventilators (Air to Air) Tracer Gas Test
AHRI 1060-2018
ASHRAE 84-2013, ASHRAE 37-2009

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	R Shephard	11/1/19 9:49 PM	Serial Number1:	N/A

DATA STATISTICS G104075023_CRTHVAC18_7438

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	29.06	29.07	0.01	29.06	[in Hg]
Dry Bulb 1	70.28	70.37	0.09	70.32	[°F]
Wet Bulb 1	52.15	52.28	0.13	52.24	[°F]
Dry Bulb 2	71.51	71.56	0.05	71.54	[°F]
Wet Bulb 2	52.66	52.80	0.14	52.74	[°F]
Dry Bulb 3	72.30	72.37	0.07	72.34	[°F]
Wet Bulb 3	52.49	52.71	0.22	52.66	[°F]
Dry Bulb 4	71.41	71.48	0.07	71.45	[°F]
Wet Bulb 4	52.16	52.36	0.20	52.31	[°F]
Nozzle Temperature 1	70.12	70.22	0.09	70.17	[°F]
Nozzle Diff Pressure 1	1.14	1.24	0.10	1.19	[in H2O]
Before Nozzle Pressure 1	1.79	2.21	0.43	1.99	[in H2O]
Nozzle Temperature 2	71.35	71.42	0.07	71.40	[°F]
Nozzle Diff Pressure 2	1.18	1.28	0.10	1.23	[in H2O]
Before Nozzle Pressure 2	-7.79	-6.72	1.07	-7.25	[in H2O]
Nozzle Temperature 3	72.21	72.33	0.13	72.29	[°F]
Nozzle Diff Pressure 3	1.14	1.25	0.11	1.20	[in H2O]
Before Nozzle Pressure 3	3.98	4.75	0.77	4.32	[in H2O]
Nozzle Temperature 4	71.33	71.39	0.05	71.37	[°F]
Nozzle Diff Pressure 4	1.15	1.24	0.10	1.20	[in H2O]
Before Nozzle Pressure 4	-1.78	-1.09	0.69	-1.45	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Mass Flow 1	18,326.20	19,072.89	746.69	18,730.04	[lb/hr]
Mass Flow 2	18,355.43	19,086.80	731.36	18,753.38	[lb/hr]
Mass Flow 3	18,275.20	19,119.53	844.33	18,754.88	[lb/hr]
Mass Flow 4	18,240.68	18,982.03	741.35	18,625.84	[lb/hr]
1 to atm	-3.60	-3.57	0.03	-3.58	[in H2O]
1 to 2 Delta P	0.64	0.74	0.10	0.69	[in H2O]
2 to atm	-4.29	-4.26	0.04	-4.27	[in H2O]
2 to 3 Delta P	-5.62	-4.30	1.32	-5.00	[in H2O]
3 to atm	0.71	0.76	0.04	0.73	[in H2O]
3 to 4 Delta P	0.64	0.72	0.09	0.68	[in H2O]
4 to atm	0.03	0.08	0.05	0.06	[in H2O]
4 to 1 Delta P	-4.94	-3.64	1.29	-4.31	[in H2O]
Relative Humidity 1	27.43	27.81	0.38	27.64	[%]
Relative Humidity 2	26.29	26.67	0.39	26.49	[%]
Relative Humidity 3	24.05	24.60	0.55	24.49	[%]
Relative Humidity 4	24.91	25.43	0.52	25.32	[%]
Air Flow Rate 1	4,072.63	4,238.56	165.94	4,162.37	[SCFM]
Air Flow Rate 2	4,079.12	4,241.65	162.53	4,167.56	[SCFM]
Air Flow Rate 3	4,061.29	4,248.93	187.63	4,167.89	[SCFM]
Air Flow Rate 4	4,053.62	4,218.37	164.75	4,139.21	[SCFM]
Room Ambient	68.60	69.68	1.08	69.09	[°F]

intertek
Total Quality. Assured.

Energy Recovery Ventilators (Air to Air) Tracer Gas Test

AHRI 1060-2018

ASHRAE 84-2013, ASHRAE 37-2009

Rev V1.1
4/29/19

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001 G104075023			Ratings:	
Test Type:	Private Testing	Unit Type:	Heat Pipe	EATR:	[%]
Test Parameter:	Recirculating 20 gpm of 41% Ethelyne Glycol	Test Type:	TRACER 5.0" Delta	OACF:	[-]
Manufacturer:	Heat Pipe Technologies			Static: 5.0	[in H2O]
Model Number:	HPT SMART GLYCOL 01	Hose Size:	24	Purge: N/A	[°]
Serial Number:	N/A				
Technician:	R Shephard	Facility No.:	CRTHVAC18		
Date:	11/1/19 3:08 PM			Air Flow Sup/Ex: 4166 4166	[SCFM]

TEST DATA

G104075023_CRTHVAC18_7436

	1		2		3		4		
Barometer	28.97		28.97		28.97		28.97		[in Hg]
Dry Bulb	72.35		72.02		71.47		71.76		[°F]
Wet Bulb	54.11		53.97		53.06		53.27		[°F]
Nozzle Temperature	72.31		71.63		71.41		71.53		[°F]
Nozzle Diff Pressure	1.23		1.20		1.20		1.20		[in H2O]
Before Nozzle Pressure	10.82		3.56		4.34		-1.48		[in H2O]
Nozzle A [Lg/Sm]	0.5017	0.501	0.4985	0.5027	0.5005	0.4985	0.502	0.5007	[in]
Nozzle B [Lg/Sm]	5.5098	0	5.5046	0	5.4974	0	5.5036	0	[in]
Nozzle C [Lg/Sm]	7.0035	0	6.9948	0	6.9975	0	6.9988	0	[in]
Nozzle D [Lg/Sm]	9.9975	0	9.9985	0	9.9935	0	9.9973	0	[in]
Tracer Reading 1	0.103774523		0.05248045		15.87000939		16.28103337		[ppm]
Tracer Reading 2	0.105154031		0.043074829		15.80412414		16.17836665		[ppm]
Tracer Reading 3	0.106391648		0.04567356		15.72984701		16.45476331		[ppm]
Tracer Reading 4	0.106375882		0.054131919		15.79537515		16.14979852		[ppm]
Tracer Reading 5	0.107526786		0.05090781		15.81055197		16.05105992		[ppm]
Tracer Reading 6	0.104469532		0.055913456		15.87233055		16.0362402		[ppm]
Average Tracer Reading	0.1056154		0.050363671		15.81370637		16.19187699		[ppm]

CALCULATIONS

	1	2	3	4	
Nozzle Specific Volume (v'n)	13.52338729	13.75261491	13.716791	13.92348402	[ft^3/lbm]
Nozzle Humidity Ratio (W)	0.005038797	0.005035765	0.004649149	0.004700179	[lbmwv/lbma]
Volumetric Air Flow	4320.202003	4306.981848	4293.674936	4330.048992	[CFM]
Standard Volumetric Air Flow	4238.131989	4154.750787	4154.329663	4127.120474	[SCFM]
Mass Air Flow	19167.69184	18790.52912	18781.39692	18659.33405	[lb/hr]
Relative Humidity	29.06222939	29.37279642	27.63821185	27.67115235	[%]

TEST RESULTS

	Value	% of Rating	
EATR 1	-0.325341295		[%]
EATR 2	-0.395434873		[%]
EATR 3	-0.388634178		[%]
EATR 4	-0.33299742		[%]
EATR 5	-0.360560945		[%]
EATR 6	-0.307943331		[%]
Average EATR	0.00 *		[%]
OACF	1.020071958		[-]

STABILITY

			Value	Status	
Air Flow Mass Inequality	Equ.	17	0.026580855	GOOD	[-]
Tracer Gas Mass Inequality	Equ.	18	0.013721455	GOOD	[-]

NOTES

Tracer 5.00

* Negative EATR values indicate no transfer of gas.

Energy Recovery Ventilators (Air to Air) Tracer Gas Test
AHRI 1060-2018
ASHRAE 84-2013, ASHRAE 37-2009

PROJECT / UUT INFORMATION

Report / Project#:	104075023CRT-001	G104075023	Manufacturer:	Heat Pipe Technologies
	Private Testing	Recirculating 20 gpm of 41	Model Number1:	HPT SMART GLYCOL 01
Technician/Time:	R Shephard	11/1/19 3:08 PM	Serial Number1:	N/A

DATA STATISTICS G104075023_CRTHVAC18_7436

Channel Name	Minimum	Maximum	Delta	Average	Units
Barometer	28.96	28.98	0.02	28.97	[in Hg]
Dry Bulb 1	72.04	72.57	0.52	72.35	[°F]
Wet Bulb 1	54.01	54.26	0.25	54.11	[°F]
Dry Bulb 2	71.74	72.18	0.43	72.02	[°F]
Wet Bulb 2	53.86	54.10	0.23	53.97	[°F]
Dry Bulb 3	71.33	71.58	0.25	71.47	[°F]
Wet Bulb 3	52.91	53.16	0.25	53.06	[°F]
Dry Bulb 4	71.44	71.93	0.49	71.76	[°F]
Wet Bulb 4	53.06	53.38	0.32	53.27	[°F]
Nozzle Temperature 1	72.05	72.59	0.54	72.31	[°F]
Nozzle Diff Pressure 1	1.19	1.27	0.07	1.23	[in H2O]
Before Nozzle Pressure 1	10.66	11.00	0.35	10.82	[in H2O]
Nozzle Temperature 2	71.37	71.86	0.49	71.63	[°F]
Nozzle Diff Pressure 2	1.17	1.24	0.06	1.20	[in H2O]
Before Nozzle Pressure 2	3.31	3.79	0.48	3.56	[in H2O]
Nozzle Temperature 3	71.29	71.63	0.34	71.41	[°F]
Nozzle Diff Pressure 3	1.16	1.24	0.08	1.20	[in H2O]
Before Nozzle Pressure 3	4.00	4.62	0.62	4.34	[in H2O]
Nozzle Temperature 4	71.24	71.75	0.50	71.53	[°F]
Nozzle Diff Pressure 4	1.16	1.25	0.08	1.20	[in H2O]
Before Nozzle Pressure 4	-1.77	-1.21	0.56	-1.48	[in H2O]
Inst. Nozzle Humdity Ratio 1	0.01	0.01	0.00	0.01	[lbmwv/lbma]
Inst. Nozzle Humdity Ratio 3	0.00	0.00	0.00	0.00	[lbmwv/lbma]
Mass Flow 1	18,859.05	19,420.30	561.25	19,125.70	[lb/hr]
Mass Flow 2	18,501.35	18,994.33	492.98	18,751.52	[lb/hr]
Mass Flow 3	18,392.84	19,037.50	644.66	18,749.39	[lb/hr]
Mass Flow 4	18,325.56	18,962.32	636.76	18,627.40	[lb/hr]
1 to atm	6.40	6.43	0.03	6.41	[in H2O]
1 to 2 Delta P	0.63	0.73	0.09	0.68	[in H2O]
2 to atm	5.72	5.75	0.03	5.73	[in H2O]
2 to 3 Delta P	4.66	5.34	0.68	5.00	[in H2O]
3 to atm	0.72	0.74	0.02	0.73	[in H2O]
3 to 4 Delta P	0.64	0.72	0.08	0.68	[in H2O]
4 to atm	0.04	0.06	0.02	0.05	[in H2O]
4 to 1 Delta P	5.37	6.02	0.65	5.68	[in H2O]
Relative Humidity 1	28.70	29.57	0.87	29.16	[%]
Relative Humidity 2	29.04	29.85	0.80	29.47	[%]
Relative Humidity 3	27.54	27.90	0.36	27.74	[%]
Relative Humidity 4	27.54	27.90	0.36	27.77	[%]
Air Flow Rate 1	4,191.04	4,315.76	124.73	4,250.30	[SCFM]
Air Flow Rate 2	4,111.55	4,221.10	109.56	4,167.14	[SCFM]
Air Flow Rate 3	4,087.43	4,230.70	143.26	4,166.67	[SCFM]
Air Flow Rate 4	4,072.48	4,213.99	141.51	4,139.56	[SCFM]
Room Ambient	66.80	68.60	1.80	67.62	[°F]