

Measured ERV Performance



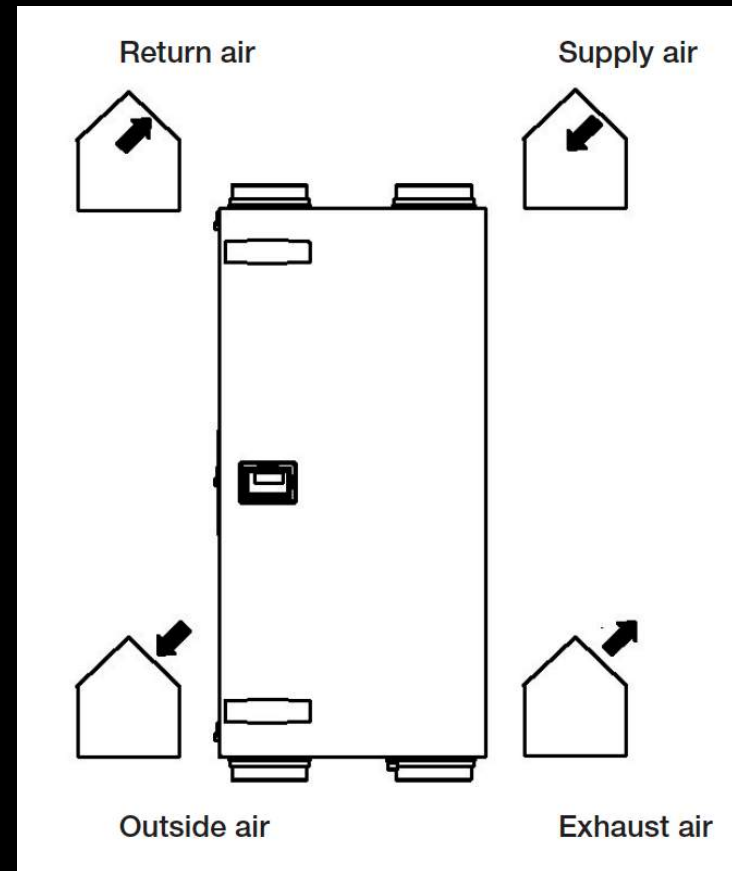
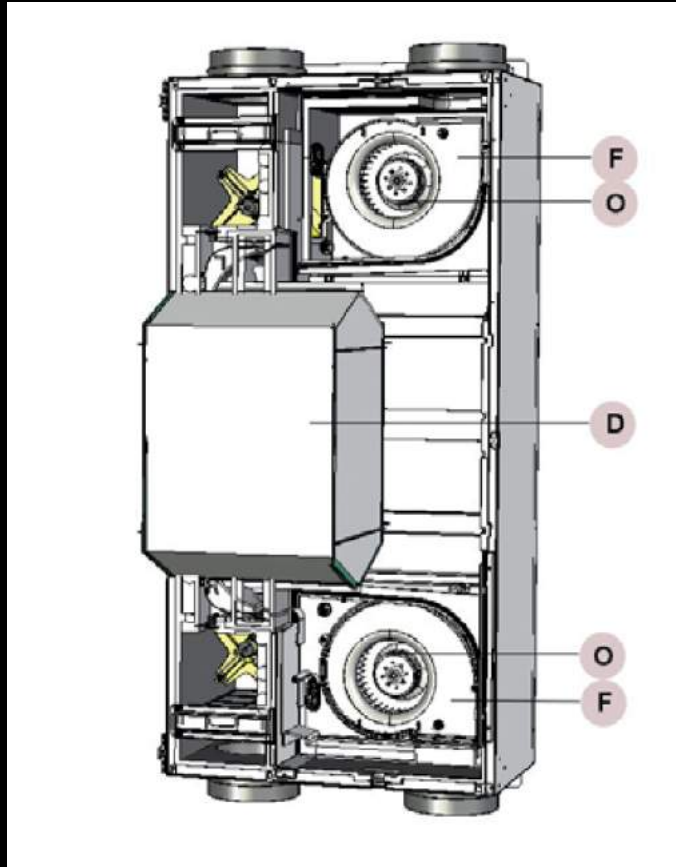
The Objective

Characterize the heat recovery performance
of my Zehnder CA200 ERV

The Set-up and Operation

- ERV: Zehnder CA200 ERV
- 3 supply locations (BRs) 2 exhaust locations (baths)
- Balanced to 53 CFM supply and 50 CFM exhaust
- No boost – constant flow
- Very little preheat energy (2.36 kWh)
- 5 minute interval temperature monitoring on all four air streams at the unit connections 10/25/15 through 3/30/16 (except 34 hours...)
- >180,000 temperature data points

Zehnder CA200 ERV



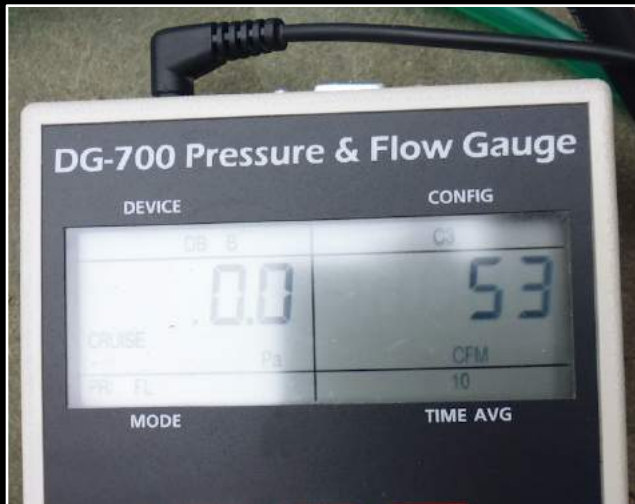
Balancing

- Late October, 60F outdoors, 67F indoors
- Duct Blaster used as site-assembled powered flow hood

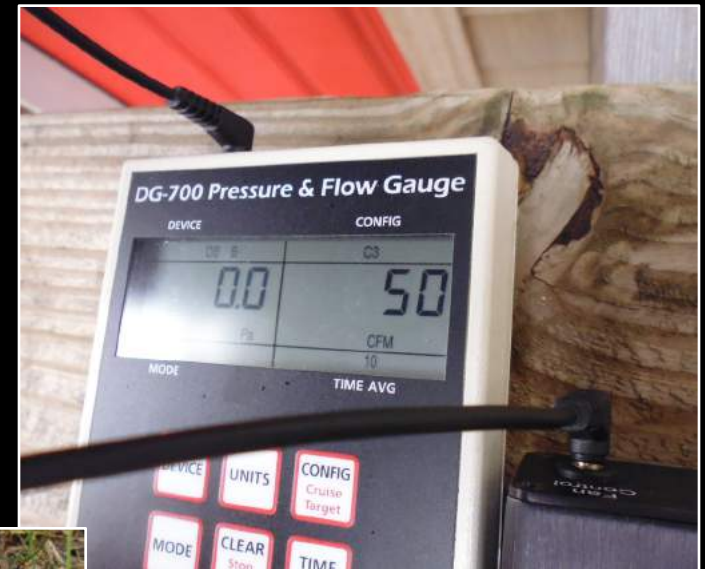


Measured ERV - Marc Rosenbaum, P.E.

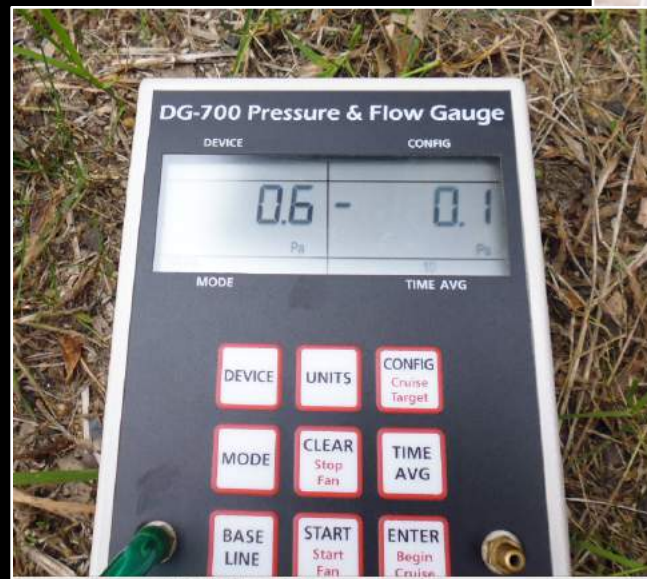
Balancing



Supply



Exhaust



1st Fl wrt outdoors

Temperature Measurement



Onset Computer
UX120-006M and (4)
TMC20-HD sensors –
5 minute sampling



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Data

- Data taken 10-25-15 through 3-30-16
- Sorted into 10°F temperature bins starting with -10°F to 0°F up to 60°F to 70°F
- Temperatures within each bin were averaged

Effectiveness

- Effectiveness is the measure of how much of the temperature differential between outdoor and indoor air is recovered by the ventilator
- Effectiveness is affected by motor heat; heat transfer through the case; and internal condensation
- In this case (15-16W total power; well insulated case; ERV core) these effects are modest – all below 1°F

The Corrections

- Raw temperature data has to be corrected by the actual mass flow of each of the two air streams as temperature varies to properly calculate effectiveness
- These correction calculations are complicated and involve assumptions – increased friction from denser air reduces the volume flow but denser air increases the mass of the air needing to be heated

Results

Temperature bin	Average Fresh Temp within bin, °F	Exhaust Temp, °F	Fresh Temp, °F	Supply Temp, °F	Return Temp, °F	# of points	# of hours	Heating degree hours @ 68F	uncorrected effectiveness	Correction for temperatures and unbalanced flow	mass flow corrected effectiveness	BTU/bin balanced to 53 CFM; 68F indoors	BTU/bin load, no ERV; 68F indoors
-10F to 0F	-2.1	27.5	-2.1	57.3	66.4	49	4	286	0.866	1.036	0.898	1,650	16,100
0F to 10F	4.0	27.9	4.0	59.5	70.1	104	9	555	0.840	1.037	0.871	4,021	31,226
10F to 20F	15.7	33.2	15.7	56.5	67.9	521	43	2270	0.782	1.040	0.814	23,808	127,795
20F to 30F	26.1	38.5	26.1	57.8	68.6	4866	406	17008	0.746	1.043	0.778	212,834	957,303
30F to 40F	35.2	45.0	35.2	60.4	69.6	11392	949	31171	0.734	1.045	0.767	408,466	1,754,464
40F to 50F	44.7	52.1	44.7	63.4	70.1	15610	1301	30260	0.736	1.047	0.771	390,477	1,703,211
50F to 60F	54.3	59.2	54.3	66.3	70.3	10566	881	12044	0.747	1.049	0.783	146,818	677,898
60F to 70F	65.4	65.4	62.6	69.2	71.6	2243	187	1010	0.740	1.052	0.778	12,610	56,864
						45351	3779	94604			0.775	1,200,685	5,324,860

always around you **zehnder**

Enthalpy Plate Exchanger WHR200 Efficiency (CA 200 ERV)						
Air Flow	Heating			Cooling		
	Sensible Effectiveness	Latent Effectiveness	Total Effectiveness	Sensible Effectiveness	Latent Effectiveness	Total Effectiveness
[CFM]	[%]	[%]	[%]	[%]	[%]	[%]
35	87	74	83	87	65	72
71	81	65	77	81	54	63
118	73	54	68	73	42	52

Heating Conditions: Outside: 0°C 75% RH
Inside: 22°C 40% RH

Cooling Conditions: Outside: 35°C 50% RH
Inside: 24°C 50% RH

Tolerances: Sensible Effectiveness: ± 4.0
Latent Effectiveness: ± 4.5
Total Effectiveness: ± 4.0

Compared to PH Calculation

- It all depends on what you use for the adjusted SRE
- CA200 HRV and CA350 HRV are 90% @ 65 CFM
- CA350 ERV is 81% @ 64 CFM
- All of these would over-predict savings

Additional calculations

5 months at 53 CFM; 68F indoors	
Load, no ERV, BTU	5,324,860
Load, with ERV, BTU	1,200,685
Load with ERV, kWh	352
Saved, BTU	4,124,175
Saved, kWh	1,209
ERV input kWh	62
ERV COP	20
HP COP	3
ERV COP after HP	6.5
Saved kWh after HP	403
HP load per CFM, kWh	2.2

south mountain company is



art



science



craft



people

Thank You!

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