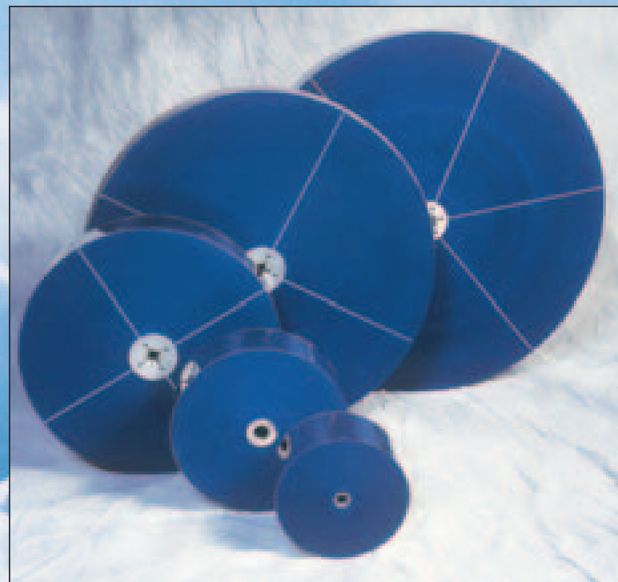
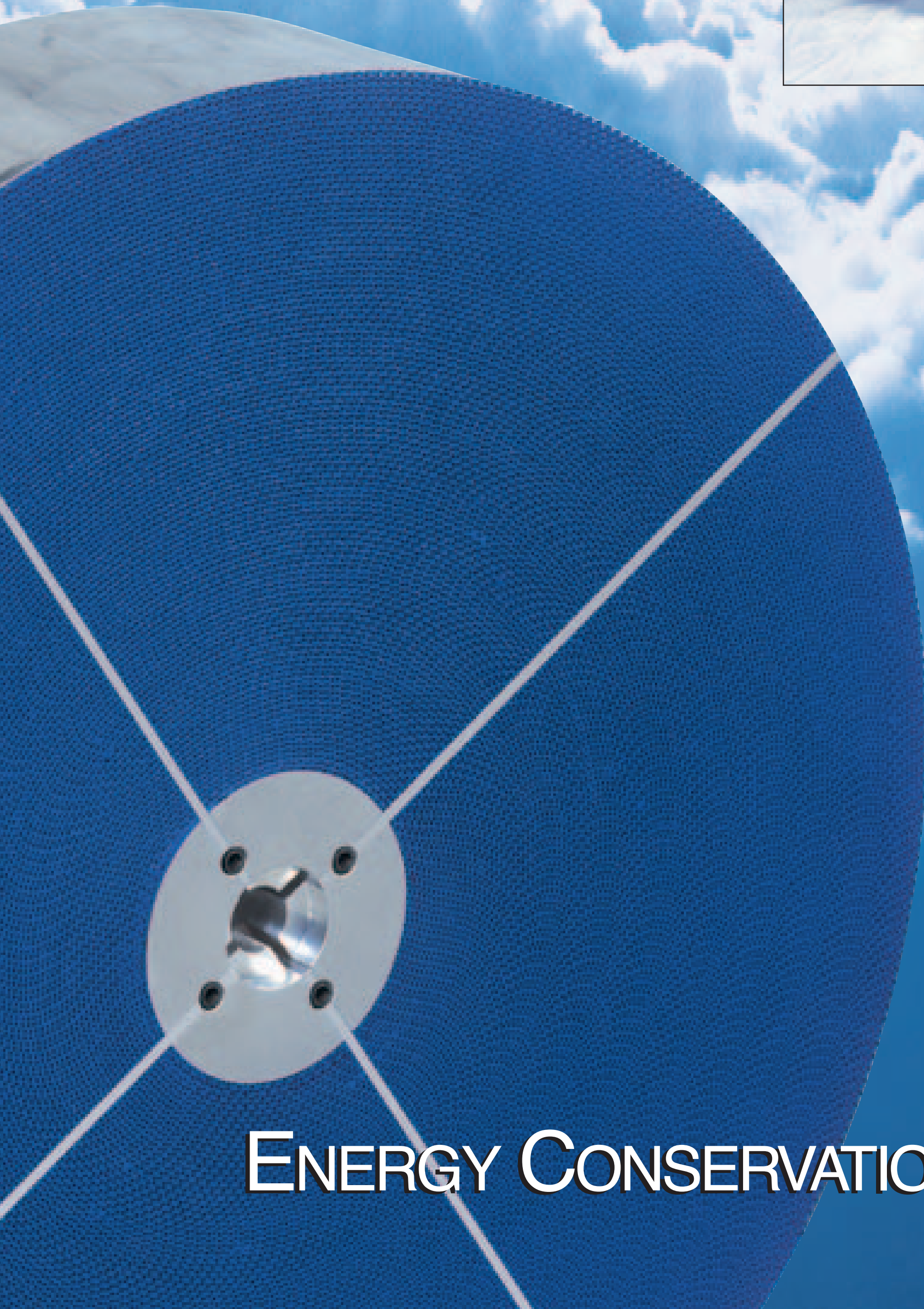
NOVEL AIRE TECHNOLOGIES

HEAT & MASS TRANSFER PRODUCTS





MANUFACTURER CERTIFIED TO ARI AS COMPLYING WITH ARI STANDARD 1060

AIR-TO-AIR ENERGY RECOVERY VENTILATION EQUIPMENT

ENERGY CONSERVATION WHEEL

NovelAire Technologies Energy Conservation Wheel

Energy Efficient Ventilation

The NovelAire Technologies Energy Conservation Wheel (ECW) is a rotary counter flow air-to-air exchanger designed to provide maximum energy efficiency in ventilated systems where heated or cooled air is exhausted and outdoor air is introduced as makeup. In applications where ventilation is required, energy wheels are used to reduce the initial investment in HVAC equipment and to minimize operating costs. Since HVAC equipment is typically the largest single source of energy consumption in residential and commercial buildings, ECW investments are economically justified on most new and retrofit HVAC systems with 15% or more outdoor air makeup. In new HVAC installations, ECWs also allow ventilated systems to be sized with smaller compressors, condensers, and other DX components, lowering the first cost of the HVAC package.

- ➢ Improves indoor air quality
- ➢ Reduces the ventilation energy penalty
- ➢ Transfers both latent and sensible energy
- ➢ Lowers operating costs
- ➢ Lowers first costs on new installations
- ➢ Both winter and summer energy savings

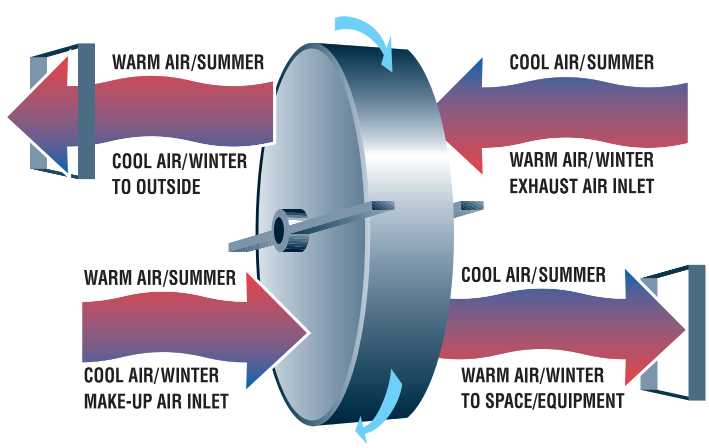
Improve Indoor Air Quality

Ventilation accomplishes several objectives: (1) It purges the conditioned space of unwanted pollutants such as organic vapors, dust, radon, etc. and, (2) It purges the space of unwanted products of human activity such as tobacco smoke, carbon dioxide, bacteria, and germs.

Poor indoor air quality has been directly associated with the "sick building syndrome", a condition that can result in high illness rates, absenteeism, and productivity decreases. Consequently, design engineers are becoming increasingly aware of the need to design proper air quality into HVAC systems.

The ASHRAE Standard 62-1989 (Ventilation for Acceptable Indoor Air Quality), describes a recommended target ratio of makeup air to return air for a variety of application and building types. Building codes in the U.S. and abroad are becoming increasingly more comprehensive in addressing ventilation requirements. Architects and engineers are, with increasing frequency, including greater amounts of fresh air makeup in their HVAC systems, and are doing so without a significant energy penalty by including exhaust air energy recovery.

The NovelAire ECW is designed to provide for all season ventilation, providing acceptable IAQ year-round, normally without the expense of additional HVAC-direct expansion capacity and with minimal extra energy costs.



ECW Features and Benefits

NovelAire ECWs are constructed of our unique corrugated synthetic fiber-based media impregnated with a non-migrating water selective molecular sieve desiccant. The fiber and desiccant, intimately bound together in our process, form sheets with excellent heat and mass transfer properties which are corrugated and spirally wound into wheels. Unlike other media, the desiccant is uniformly and permanently dispersed throughout the matrix structure in contrast to being coated, bonded, or synthesized onto the matrix, and thus is not susceptible to delamination or erosion of the desiccant material.

- Homogenous media- not coated or bonded will not delaminate
- Synthetic wheel media is completely corrosion resistant
- Synthetic wheel media maximizes desiccant loading
- Unitary wheel construction maximizes face flatness
- Fluted geometry minimizes internal cross leakage
- Molecular sieve desiccant reduces cross contamination
- Wheel is completely water washable
- ECWs offered in 4” or 6” deep wheels for single unit air volumes of 500-45,000 cfm.
- Tough wheel face resists damage

ECW Cassettes

- Heavy duty galvanized steel construction with removable side panels
- No-maintenance bearings standard on small cassettes
- Flanged outboard bearings used on larger cassettes
- Full contact brush seals minimize leakage
- Adjustable purge section reduces cross contamination
- AC drive motor with Power Twist link belt
- Optional variable speed drive motor available

Note: detailed ECW wheel and cassette specifications and software selection programs are available for download at www.novelaire.com

Performance Certification

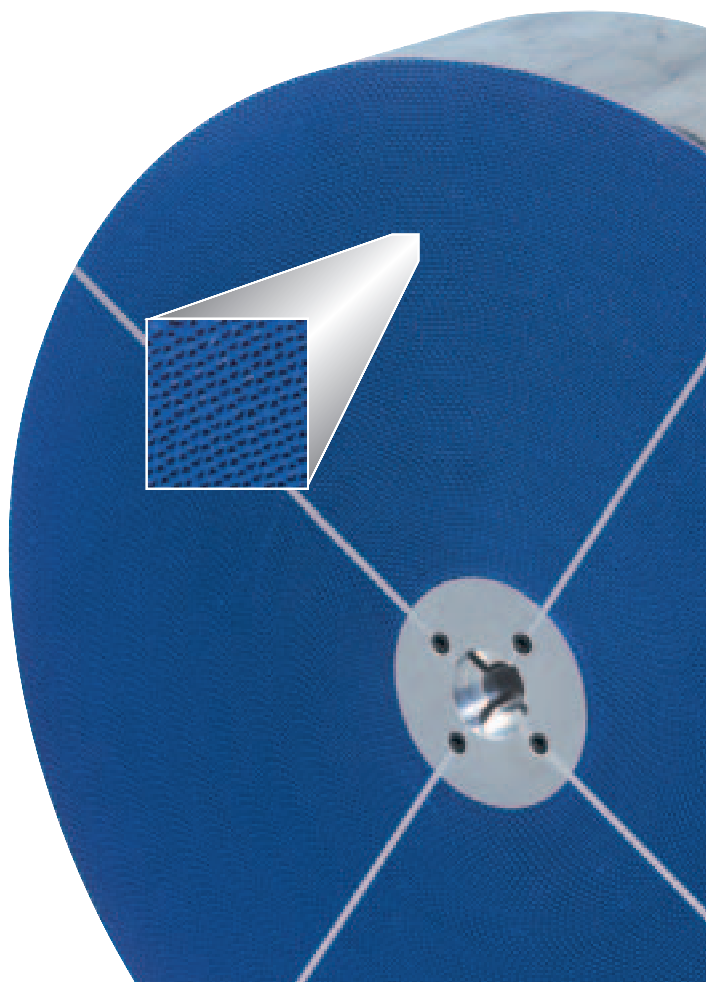
NovelAire ECWs are UL tested and are a UL recognized component for heat recovery ventilators and other HVAC equipment.

NovelAire ECWs are ARI certified using the 84-1991 ASHRAE standard (Method of Testing rotary Air-to-Air Heat Exchangers) and ARI Standard 1060 (Rating Air-to-Air Energy Recovery Equipment).

Frost Protection

During extremely cold winter time conditions, frost formation becomes a possibility in the exhaust air stream. Frost formation on the wheel will basically act to plug or reduce air flow but will not hurt the wheel itself.

In practice several types of frost prevention are employed; heating return air, heating outdoor air, variable speed control, and air bypass. NovelAire generally recommends preheating outdoor air to keep exhaust air from freezing. Wheel speed control works to limit frost formation by reducing wheel performance to a level where the exhaust air temperature is kept above the dew point.



ECW Selection and Calculations

ECW Selection

NovelAire offers a software selection program available by download at its website www.novelaire.com. The following example shows the basic concepts for selecting ECWs for a balanced system (Air Ratio = 1.0). For calculations using unbalanced Air Ratios (>1.0), please refer to our software program or contact the factory for assistance.

I. Example:

Design parameters: outdoor: 4500 cfm, 95˚F dry bulb, 75° wet bulb, 99 grains (0.0142$lb_{moisture}/lb_{dry\ air}$)

return: 4500 cfm, 75˚F dry bulb, 62.5° wet bulb, 64 grains (0.00914$lb_{moisture}/lb_{dry\ air}$)

Air Ratio (A.R.): 1.0, balanced flow.

A selection can be made as follows:

Size Determination:

If unit size is a limitation in your package, first refer to the Engineering Detail Table at the back of the brochure to identify the appropriate cassette size for your application.

For the purpose of this example, let's assume that you choose an ECW544. At 4,500 cfm, from the plot featuring the model numbers, going down vertically along the line of constant face velocity yields resulting pressure drop (here: .96 inches of water). Since both supply and return flows are equal, refer to the plot immediately above the model number plot along the same face velocity vertical line to read directly the latent, total and sensible effectivenesses for the model wanted. In the present case:

latent effectiveness: 71.5%
total effectiveness: 73.5%
sensible effectiveness: 75.2%

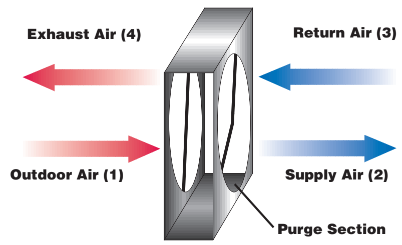
II. Exact Determination of Supply and Exhaust Air Conditions:

This section shows how a detailed picture of all incoming and outgoing flows can be derived from the examples above. The effectivenesses shown in our plots are accurately described by the following equations:

$$\varepsilon = \frac{\dot{m}_e}{\dot{m}_{min}} \frac{X_4 - X_3}{X_1 - X_3} \qquad \varepsilon = \frac{\dot{m}_s}{\dot{m}_{min}} \frac{X_1 - X_2}{X_1 - X_3}$$

Where:

ε = sensible, latent, or total heat effectiveness;
X = dry bulb temperature for sensible effectiveness, humidity ratio for latent effectiveness, total enthalpy for total effectiveness;
$\dot{m}_e$ = mass flow rate of the exhaust, mass of dry air per unit time;
$\dot{m}_s$ = mass flow rate of the supply, mass of dry air per unit time;
$\dot{m}_{min}$ = minimum value of either mass flow rate;



Going back to the above Example, we can calculate the supply air conditions. The dry bulb temperature is assessed by using the sensible effectiveness:

$$T_2 = \frac{\dot{m}_{min}}{\dot{m}_s} \varepsilon (T_3 - T_1) + T_1$$

$$= \frac{4500}{4500} 0.752 (75 - 95) + 95$$

$$= 80.0$$

Similarly, the humidity of the supply air flow is calculated using the latent effectiveness:

The supply conditions are therefore completely defined as:

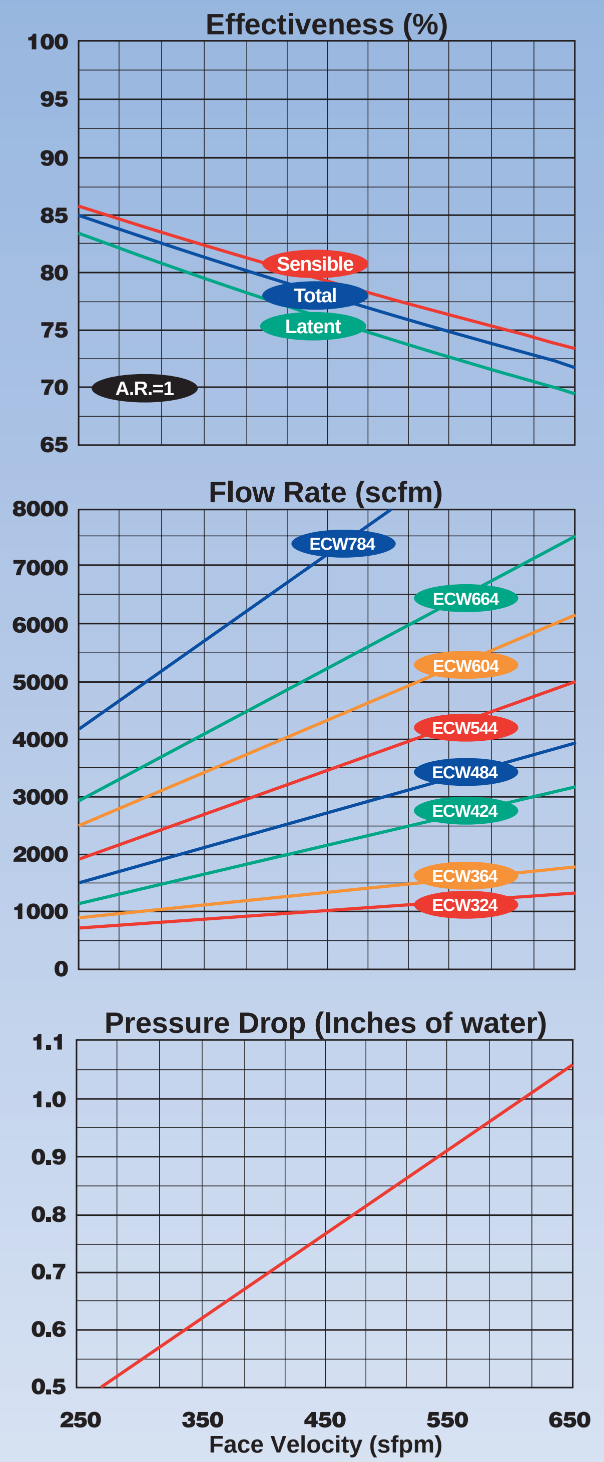
$$W_2 = \frac{\dot{m}_{min}}{\dot{m}_s} \varepsilon (W_3 - W_1) + W_1$$

$$= \frac{4500}{4500} 0.715 (64 - 99) + 99$$

$$= 74.0$$

Dry bulb temperature: 80.0˚F
Humidity: 74 grains of moisture per pound of dry air

4” Depth



LEAKAGE AND EXHAUST AIR TRANSFER

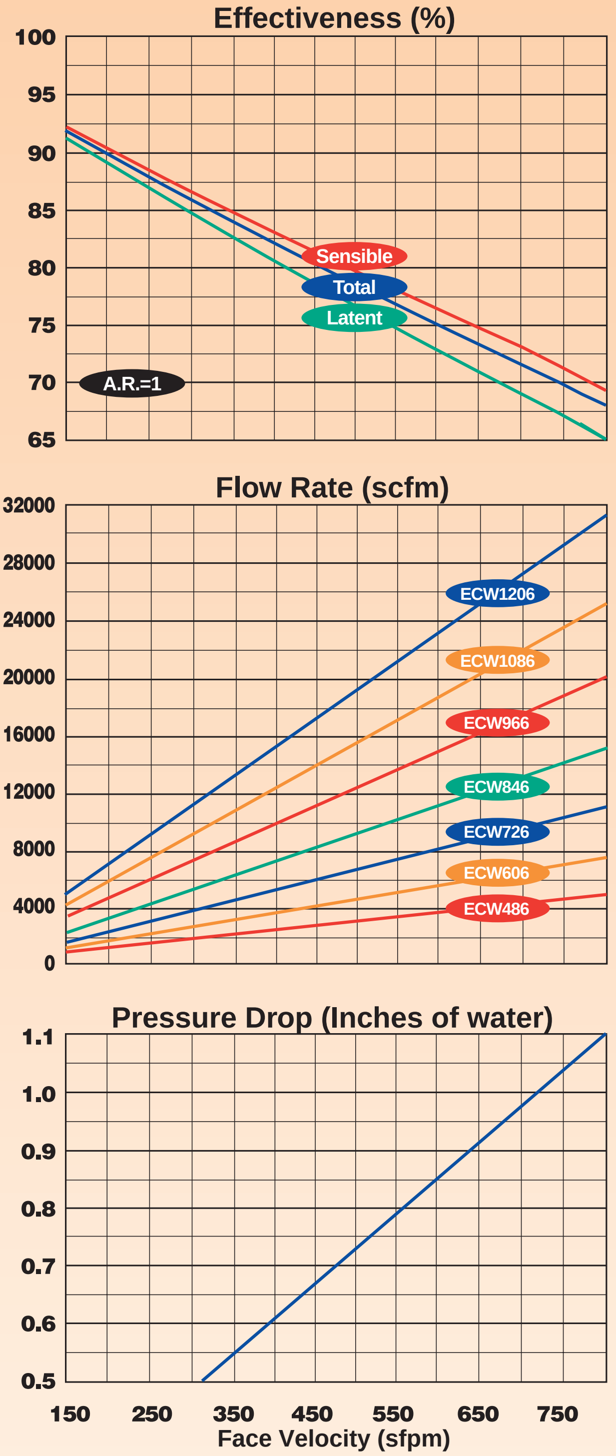
Exhaust Air Transfer Ratio (All Models)

Pressure Differential	0.0”	0.5”	3.0”
EATR	4.0%	0.1%	0.0%

Leakage-Outdoor Air Correction Factor (OACF)

	0.0”	0.5”	3.0”
ECW 324	1.04	1.08	1.21
ECW 364	1.04	1.07	1.18
ECW 424	1.04	1.06	1.16
ECW 484	1.03	1.05	1.14
ECW 544	1.03	1.05	1.12
ECW 604	1.02	1.04	1.10
ECW 664	1.02	1.03	1.09
ECW 784	1.01	1.03	1.07

6” Depth



LEAKAGE AND EXHAUST AIR TRANSFER

Exhaust Air Transfer Ratio (All Models)

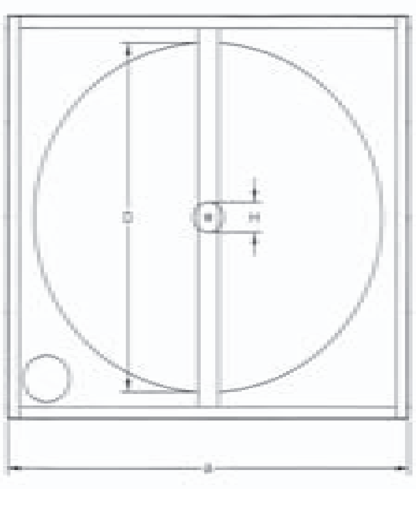
Pressure Differential	0.0”	0.5”	3.0”
EATR	4.0%	0.1%	0.0%

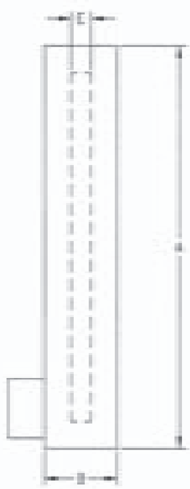
Leakage-Outdoor Air Correction Factor (OACF)

	0.0”	0.5”	3.0”
ECW 486	1.04	1.05	1.14
ECW 606	1.02	1.04	1.10
ECW 726	1.02	1.03	1.08
ECW 846	1.02	1.03	1.07
ECW 966	1.01	1.02	1.05
ECW 1086	1.00	1.01	1.04
ECW 1206	1.00	1.01	1.03

Engineering Detail

NTL Model No.	Flow Rate (scfm)	Wheel Diameter D (inches)	Wheel Depth E (inches)	Cassette Height/Width A (inches)	Cassette Depth B (inches)	Approx. Total Wt. (pounds)	Drive Motor (Hp)
ECW204	600	20	4	23	7	40	1 / 20
ECW244	900	24	4	27	7	70	1 / 20
ECW324	1500	32	4	39	7	160	1 / 2
ECW364	2000	36	4	42	7	190	1 / 2
ECW424	3000	42	4	48	7	200	1 / 2
ECW484	4000	48	4	54	8	270	1 / 2
ECW544	5000	54	4	60	8	320	3 / 4
ECW486	5000	48	6	54	10	310	1 / 2
ECW604	6000	60	4	66	8	440	3 / 4
ECW546	6000	54	6	60	10	350	3 / 4
ECW664	7500	66	4	72	9	540	1
ECW606	7500	60	6	66	10	540	3 / 4
ECW724	9500	72	4	78	9	670	1
ECW666	9500	66	6	72	11	630	1
ECW784	11000	78	4	84	9.5	720	1
ECW726	11000	72	6	78	11	700	1
ECW844	13000	84	4	90	9.5	810	1
ECW786	13000	78	6	84	12	880	1
ECW846	15000	84	6	90	12	1050	1
ECW906	17500	90	6	96	12	1130	1 1/2
ECW966	20000	96	6	102	12	1400	1 1/2
ECW1026	22500	102	6	108	12	1630	1 1/2
ECW1086	25000	108	6	116	15	2200	2
ECW1206	30000	120	6	129	15	2750	2
ECW1326	37500	132	6	140	15	3070	2
ECW13212	40000	132	12	140	21	3830	2
ECW14412	50000	144	12	153	21	4400	2





The information contained in this brochure is believed to be accurate by NovelAire Technologies, but is not warranted.

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