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GTRI

HEAT RECOVERY EFFECTIVENESS

The effectiveness in capturing sensible heat (that due to temperature differences) is determined by the percentage of maximum available energy that is transferred.

Effectiveness = Actual Heat Transfer/Maximum Heat Transfer

$$= \frac{(\text{Mass Flow} \times \text{Specific Heat})(\text{Temperature Change})}{(\text{Mass Flow} \times \text{Specific Heat})_{min}(\text{Temperature Difference})_{max}}$$

The actual heat transfer is determined by the actual flow rate and temperature change. The maximum heat transfer potential for a heat recovery device is found from the multiplication of the minimum flow rate and the maximum temperature difference. The maximum temperature for this case is the temperature of exhalation and the minimum temperature is room temperature. For the heat exchanger under consideration, the flow to be heated and flow being cooled are equal so the mass flow times specific heat terms cancel.

Test Results:

	Thermofilter	Pall
Max. Temp.(Expiration)	33.6°C	28.2°C
Room Temp. (minimum)	23.9°C	22°C
Exchanger Exit Temp. (Inhalation)	31.8°C	25.25°C
Effectiveness	81%	52%

$\text{Effectiveness}_{therm.}$ = (31.8 - 23.9)/(33.6 - 23.9)
= 7.9/9.7 = 81%

$\text{Effectiveness}_{pall}$ = (25.25 - 22)/(28.2 - 22)
= 3.25/6.2 = 52%

Increase in Heat Recovery Effectiveness = (81% - 52%)/52% = 56%

The thermofilter is approximately 56% more effective in recovering sensible heat than the Pall device. Because the room temperature was not known for the Pall test, an assumed room temperature of 22°C was used.

The test results indicate the Thermofilter device recovers 81% of the available sensible thermal energy. This compares favorably with other high efficiency heat recovery devices.