**Supplement Legends**

Supplement 1: Radar plots showing power measurements (in Jules per minute) for all threshold-partitioned equations. The red line outlines the calculations based on observed value outputs. The green line outlines the calculations based on input values predicted. The blue line outlines the measurements using planimetry. The combinations of patient and ventilator parameters were tested with four airflow resistors: parabolic resistors with a resistance of 5 cm H2O (P5) & a resistance of 20 cm H2O (P20) and linear resistors with resistance of 5 cm H2O (L5) & a resistance of 20 cm H2O (L20). The baseline tests with each resistor are in the top left of each radar plot. One variable was then changed with each subsequent test (Table 1). The type of resistor and the change from baseline is indicated next to its corresponding power values. The changes are listed in counter-clockwise order. PEEP = positive end expiratory pressure (cm H2O). C = Compliance (L per cm H2O).

Supplement 2: Variance comparison analysis demonstrating standard deviation of each observed and predicted type of threshold-partitioned equation.

Supplement 3: Main effects analysis grading the impact of a variable change on each of the threshold-partitioned equations.