Power Consumption Comparison Test for Oxygen Concentrators

Introduction

A Power Consumption Comparison Test was conducted to evaluate the power usage of the PulmO2 (1060AW) in direct comparison to a standard 10L Oxygen Concentrator (1025KS), by an independent test lab in Pennsylvania, USA. The concentrators were tested under identical environmental conditions and the data was then collected and documented.

Test Set Up

The high-quality test equipment (Table 1), ensured that the power consumption of the PulmO2 and the 1025KS was measured accurately and consistently, providing reliable data for comparison. All equipment was calibrated according to ISO/IEC 17025:2017 standards, ensuring traceability to the National Institute of Standards & Technology (NIST).

Table 1

Test Equipment	Purpose & Features
Power Meter	Used for measuring power consumption. High accuracy, real-time data logging, and the ability to measure various electrical parameters such as voltage, current, and power factor
Oxygen Analyzer (ServoMex SERVOFLEX MiniMP)	Utilized for gas analysis. Providing precise measurements with accuracy of ±0.1% using advanced Paramagnetic and Infrared sensing technologies. MCERTS and TuV certification
Flow Meter (TSI Flow Meter Model 5200)	Employed for flow measurements. Accurate measurement of gas flow rates, essential for verifying that the concentrators deliver the correct amount of oxygen as per specifications
International Power Supply	Provided the necessary power for the test. Calibrated to international standards and delivering 230VAC/50Hz
PC with Data Collection Software:	Used for recording and analysing data. Integrated systems that compile data from power meters, thermocouples, and flow meters, providing a comprehensive dataset for analysis

Technical Explanations

<u>AC vs DC Compressors</u>

A standard oxygen concentrator (1025KS) operates with an alternating current (AC) compressor that is set to a fixed and defined power value. This power value remains the same across all flow settings. Therefore, a change in the flowrate has minimal impact on power consumption.

The PulmO2 (1060AW) oxygen concentrator uses a direct current (DC) compressor. A DC compressor can be regulated via a controller. This regulation allows the compressor

speed to be adjusted according to the flow output. Therefore, a change in flowrate does have an impact on power consumption, allowing for lower power consumption corresponding to lower flowrates.

Peak vs Average Current and Power

Due to fluctuations in the power grid caused by power plants and the corresponding power network, there are small differences in the measurements of both current amps and power watts over time. Therefore, it is important to record the individual peak values (Peak Current Amps and Peak Power Watts) and calculate the corresponding average values for each setting. When evaluating the power consumption, we can safely ignore the peak values and focus only on the average values.

Results

The chart below (Graph 1) demonstrates the power (watts) required at different flowrates from 1LPM to 10LPM with power measurements taken after performance stabilization at each flow setting was achieved. The orange trend line (1025KS) shows power consumption from a device with an AC compressor compared to the blue trend line (1060AW) showing power consumption from a device with a DC compressor. With the 1060AW (DC compressor device), at lower flow settings, the energy consumption is significantly lower. Even at the highest flowrate of 10 LPM, the power consumption is still significantly lower with 1060AW (DC compressor device) compared to the 1025KS (AC compressor device).

Graph 1

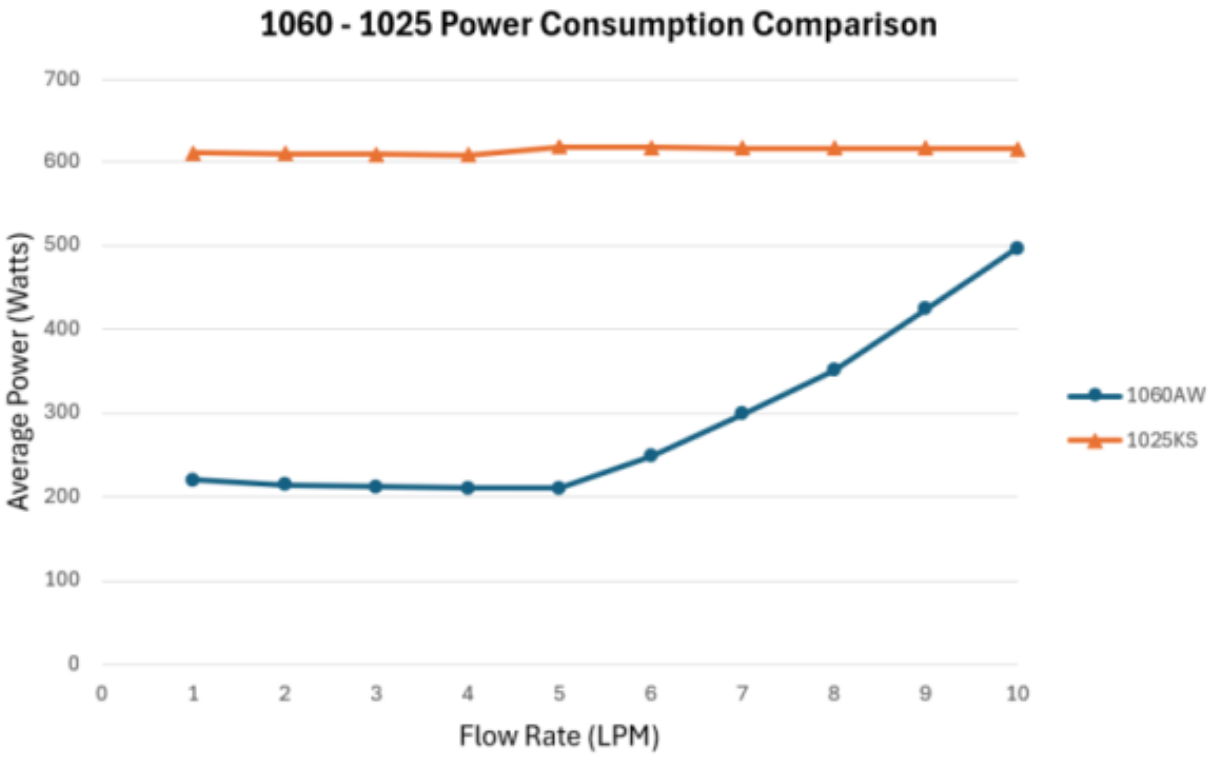

Table 2 below lists the individual measurements taken for both devices (1060AW and 1025KS) at different flowrates (1-10 LPM). The table shows how the power consumption of the 1025KS (AC compressor device) remains relatively constant[1], which is expected for an AC motor. The opposite is true for the 1060AW (DC compressor device) with significant variation due to the flowrate, with the power consumption directly proportional to the flow setting.

Table 2

	Average Current Amps (RMS)		Average Power Watts (RMS)		Peak Current Amps (RMS)		Peak Power Watts (RMS)	
Flowrate (LPM)	1060AW	1025KS	1060AW	1025KS	1060AW	1025KS	1060AW	1025KS
10	2.26	2.83	496.09	615.36	2.44	2.9	537	635
9	1.95	2.83	424.02	615.66	2.1	2.91	459	636
8	1.65	2.83	351.26	615.81	1.65	2.91	385	637
7	1.43	2.83	298.56	616.05	1.54	2.91	324	637
6	1.23	2.83	248.17	616.77	1.32	2.92	270	638
5	1.09	2.83	210.49	617.36	1.15	2.92	227	639
4	1.08	2.79	209.86	607.86	1.15	2.85	227	622
3	1.09	2.8	211.46	608.72	1.16	2.86	230	623
2	1.08	2.8	214.1	609.35	1.17	2.86	233	624
1	1.12	2.8	219.68	610	1.21	2.86	242	625

Conclusion

The 1060AW (DC compressor device) uses significantly less energy[2], especially at lower flowrates (1-8 LPM) compared to the 1025KS (AC compressor device). These results show a maximum energy saving of 66% when using the 1060AW compared to the 1025KS.

Energy cost is considered the single biggest user cost factor over the lifetime of an oxygen concentrator. By reducing the amount of power consumed, operational costs are significantly reduced, making the PulmO2 (1060AW) energy cost requirements considerably more cost effective over long-term use compared to standard, AC powered oxygen concentrators.

[1] Mean power consumption of the 1025KS across all settings is 613.3 watts (+/-3.8)
[2] Median power consumption across all flow settings of the 1060AW concentrator is 233.9 watts.