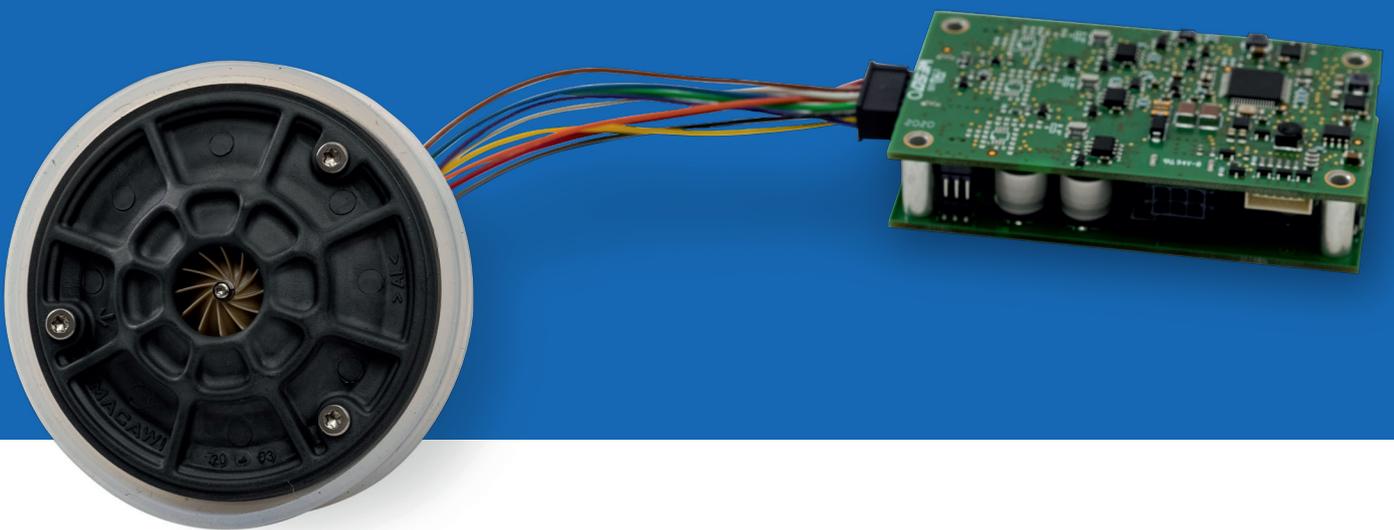


**LIFETIME REPORT**

# Macawi Turbine Blower.



## A LIFETIME OF 10+ YEARS

Demcon macawi respiratory systems developed a blower dedicated to ventilation purposes with the requirement that the blower does not need to be replaced or serviced over the regular lifetime of a ventilation device. Therefore, the lifetime design specification was that it should run more than 40,000 hours, which is equivalent to more than 10 years. To prove this specified lifetime, several tests have been running since the development of the blower.

Since November 2013 the first test setup of ten blowers have been running. In August 2014 the second setup of six blowers was added – having a total of 16 blowers in the test setup. The blowers are running under normal ventilation conditions, creating a pressure of 35mbar over 12mbar with a respiratory rate of 12 breaths per minute (simulating an average adult). These blower motors have a measured operating motor temperature of 50 degrees Celsius and the motor temperature is continuously monitored.

- Environmental Temperature 20 ° C
- Motor temperature 50 ° C
- Peep / PInsp: 12 / 35 mbar
- Ti / Te: 2.0 / 3.0 (= RR=12)

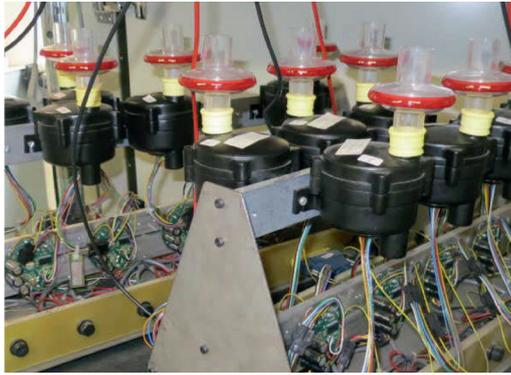


Figure 1: Test setup for blower lifetime testing

## RESULTS

The blowers under test have been running for 63,500 hours and 56,500 hours (status in January 2021).

- November 2013: blowers running 63,500 hours = 144,780,109 revolutions and 91,440,106 pressure swings of 25 mbar (up and down).
- August 2014: Blowers running 56,500 hours = 144,000,000 revolutions and 81,360,106 pressure swings of 25 mbar (up and down).

### Defect units

- At this moment all blowers are still running, no defects have been found over the years.

During the test, two motors from the initial batch (November 2013) are taken out for destructive investigation of the bearings. The bearing quality was still good. From this moment 14 blowers are in the test (eight from the first, and six from the second batch).

## STATISTICAL ANALYSIS

For the statistical analysis, the Weibull Analysis is used. The choice for this method is based on the fact that the main cause of failure, for this type of mechanic system, is bearings wear. Literature shows that for bearings lifetime analysis, the Weibull method is the most commonly used method.

Based on this data a Weibull analysis is executed to determine the L10 lifetime value for the blower. The L10 value presents the time in hours after which 90% of the blower population is still operable. This value can be calculated for different confidence levels, typically a 95% confidence level is used in the presented calculations.

## CONCLUSION

- The blowers have an L10 lifetime value of more than 45,000 hours when using them on a motor temperature level of 50 degrees Celsius.
- The blowers under test have been running for 63,500 hours and 56,500 hours (status in January 2021) respectively for both sets and no defects are reported.

The motor temperature of the blower is specified to operate at a maximum temperature of 70 degrees Celsius. Using the blower continuously on a higher motor temperature will result in a reduced lifetime. Tests are currently running to investigate the blower lifetime at higher motor temperatures.