

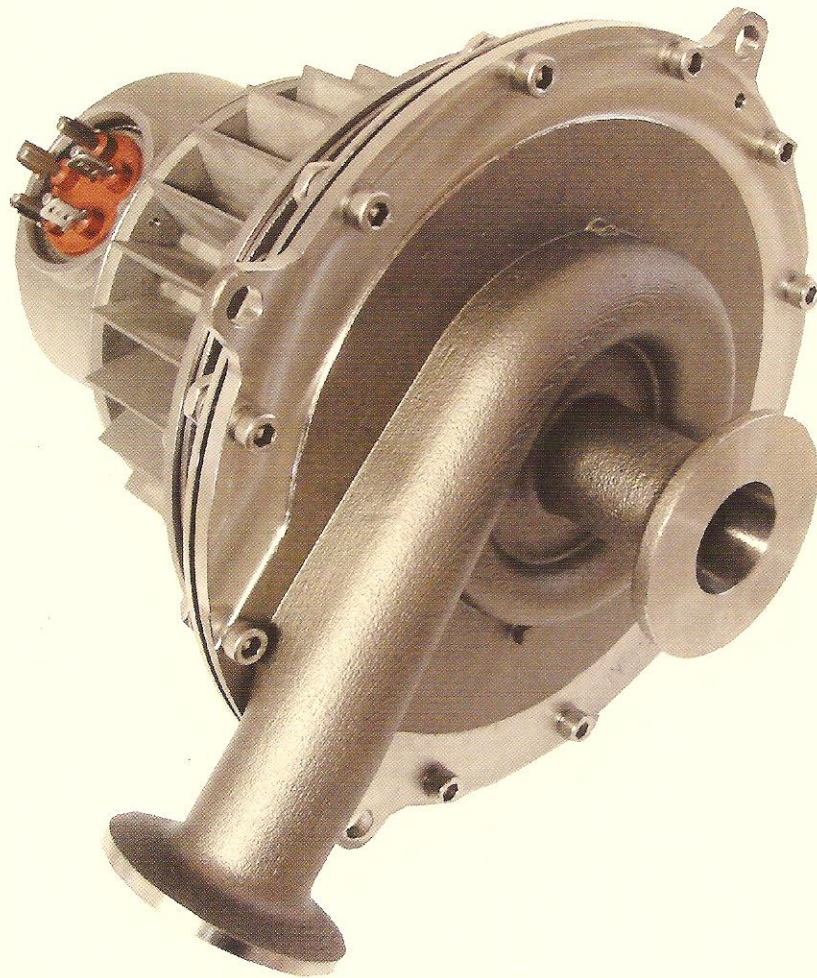


# *Fuel Cell Blowers*

**Cathode ● Anode ● Fuel ● Recycle**

**with**

**Advanced Foil Air/Gas Bearing Technology**

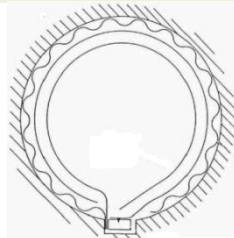






### *How Foil Bearings Work*

The motor/rotor shaft is supported radially by two journal bearings and axially by two thrust bearings. As the shaft rotates, a wedge is formed due to the radial displacement of the shaft. Hydrodynamic action draws the working gas into the wedge where it is locally compressed. The pressurized section provides support for the shaft while the layers of foil provide the compliant features of the bearing. As the shaft speed increases, a hydrodynamic film of gas is produced that forces the shaft to lift off and become airborne eliminating any contact between the shaft and the bearing.



Typical Foil Bearing

### *Blowers with Advanced Foil Bearings Provide*

**HIGHER EFFICIENCY** – Foil bearings allow operation at high speeds, thus achieving improved aerodynamic efficiency.

**HIGHER RELIABILITY** – Foil bearing machines require no lubrication, and similar machines for aircraft have demonstrated reliability up to more than 100,000 hours of operation.

**COMPACT SIZE** – The ability to operate reliably at high speed allows designs to be lightweight and very compact.

**OIL FREE** – Foil bearing machines are completely oil-free, and hence environmentally friendly.

**LOW NOISE & VIBRATION** – Foil bearings provide low noise and low vibration due to no metal-to-metal contact.

**NO SCHEDULED MAINTENANCE** – Foil bearings do not require lubrication, resulting in lower operating costs.

**WIDE TEMPERATURE RANGE (4K to 1,255K)** – Foil bearings do not encounter the problems lubricants typically cause : breaking down at very high temperatures and becoming too viscous at low temperatures.

**R&D Dynamics Corporation** designs, develops and manufactures a complete range of high-speed oil-free fuel cell blowers supported on foil air/gas bearings. As a core technology provider to the SECA (Solid State Energy Conversion Alliance), R&D Dynamics Corporation has been providing high-efficiency, high-reliability, maintenance-free, oil-free fuel cell blowers for cathode, anode, fuel and recycle applications.

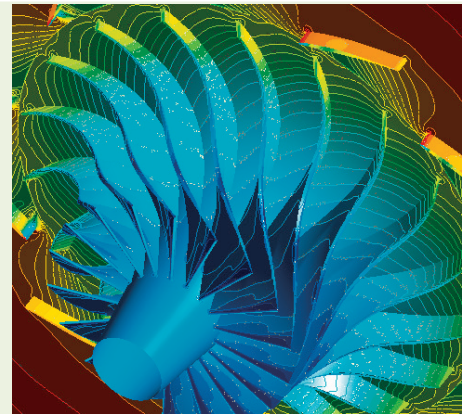
### *High Efficiency Achieved From*

#### **Optimized Aerodynamic Blower Design**

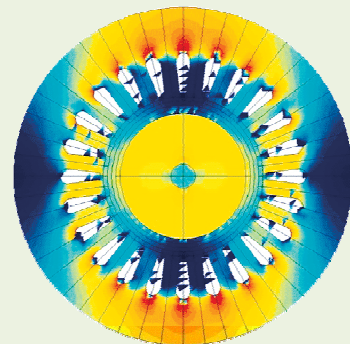
– Blower blade geometry is optimized for high speed operation with foil bearings and the high-speed motor. Computational Fluid Dynamics (CFD) is applied to achieve highly efficient flow path and blade profiles.

**PMSM(Permanent Magnet Synchronous Motor)** – R&D Dynamics' PMSM provides higher efficiency, smaller volume and higher power density in high-speed applications.

**Sensorless PMSM Drive** – R&D Dynamics' PMSM drive provides an optimized sensorless vector control with higher efficiency and compact size.



*Optimized blade design using CFD*



*PMSM magnetic circuit design using Finite Element Analysis*

# Performance Focused Engineering

## Bearings

All fuel cell blowers come equipped with state-of-the-art foil air/gas bearings. R&D Dynamics Corporation has decades of experience building high-speed turbomachinery supported on foil bearings. Bearings are designed and manufactured in-house using proprietary methods. All foil bearings are tested on journal and thrust bearing test rigs.

## Computational Fluid Dynamics (CFD) -Aided Design

All fuel cell blower aerodynamic designs are completed using CFD analysis. High efficiency blower geometry is obtained by using proprietary in-house design methods which have been correlated with test data. CFD analysis finalizes aerodynamic design to obtain optimized blower flow paths and blade profiles.

## Finite Element Analysis (FEA)

All fuel cell blower designs are evaluated using FEA software. High rotational speeds demand careful attention to stresses in the rotating assembly. In addition, rotor dynamics must be properly analyzed to prevent unwanted shaft critical speeds.

## Motors and Drives

All fuel cell blowers are driven by high-efficiency PMSM and sensorless drives. High-speed and high-efficiency PMSM and sensorless drives are designed and fabricated in-house using proprietary methods. All motors and drives are tested on component test rigs before blower assembly.

## Testing and Design Capabilities

All fuel cell blowers are qualification tested to verify adherence to strict design criteria. Performance is measured using approved procedures and standards. Vibration and shaft displacement are monitored during qualification testing to ensure long life and high reliability.

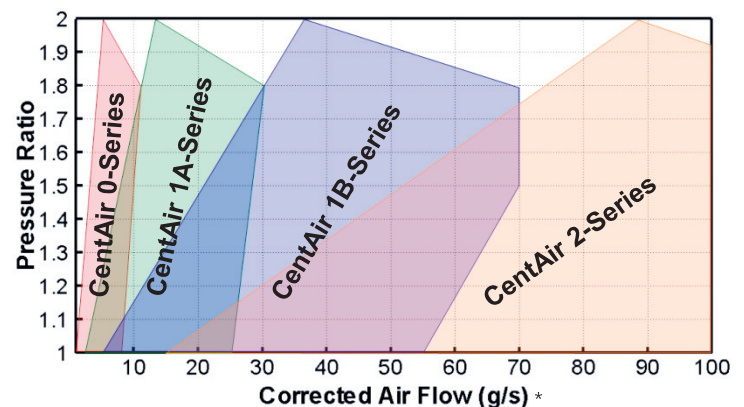
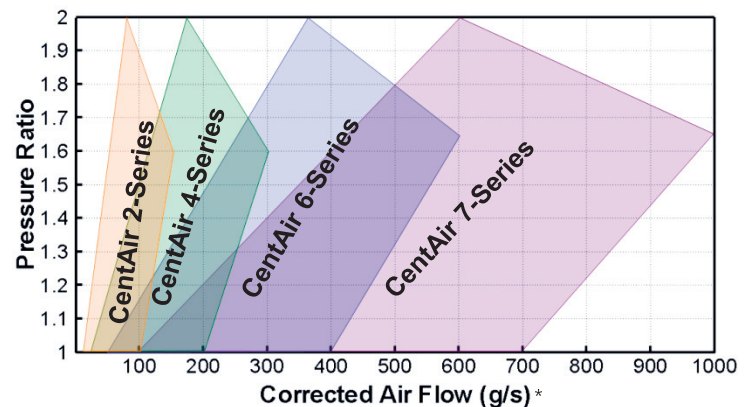
## High-Temperature Recycle Blower

R&D Dynamics Corporation offers high-temperature recycle blowers supported on foil gas bearings.

- Gas temperature can be as high as **850°C**.
- Blowers are corrosion resistant.
- Motor is hermetically sealed.
- Heat leakage is minimized.

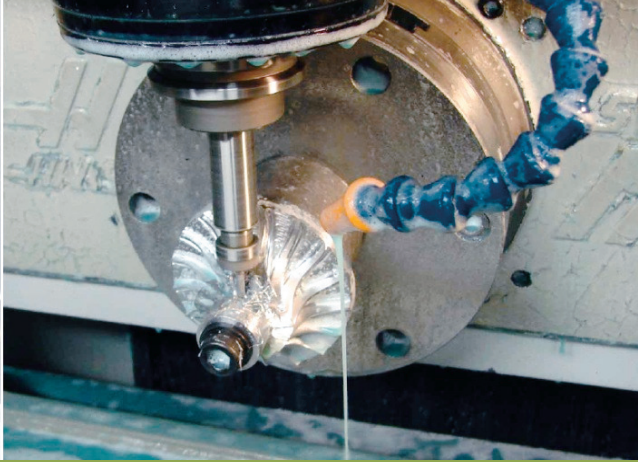


## R&D Dynamics Blower Models



\*Corrected inlet conditions : 1 atm, 15°C





## Manufacturing

R&D Dynamics Corporation applies state-of-the-art Computer-Aided Design and Manufacturing (CAD/CAM).

High efficiency compressors, turbines and fans are manufactured in-house using CNC Lathes and 5-axis Milling Machines. Other parts such as shafts, foil bearings and seals are also manufactured in-house. Outside approved subcontractors are used for specialized processes such as heat treatment and plating.

## Quality

R&D Dynamics Corporation is ISO 9001:2000 / AS9100 certified and registered.

The inspection system is approved by the FAA (Federal Aviation Agency). We have state-of-the-art inspection equipment including computer-controlled Coordinate Measuring Machines (CMM) in temperature and humidity monitored rooms.



## E-mail Us

In order to design and manufacture fuel cell blowers for your specific needs, please e-mail

[mktg@rddynamics.com](mailto:mktg@rddynamics.com)

with the following information :

- Gas Type (including Component Mol%)
- Inlet Pressure
- Inlet Temperature
- Gas Flow Rate
- Pressure Rise (or Outlet Pressure)

## Customer Satisfaction



Registered to  
AS9100  
(with ISO 9001)

*We believe in total customer satisfaction and quality management.*

*We believe in going the extra 'mile' for our customers.*

*We will work with you to meet your needs in every possible way.*

**Your Success Is Our Success®**

Please call, write, e-mail or fax your requirements.

**We Are Here To Help You.™**



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