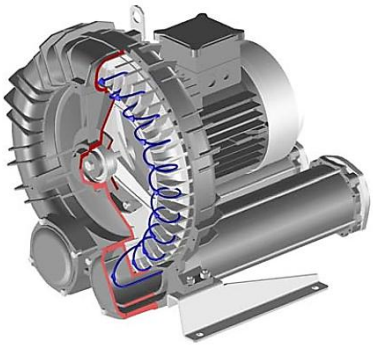
“Therec Services Co., Ltd.”

Total Solution for Biogas Blower and Compressor
Process & Equipment for Biogas Boosting & Aeration System






Side Channel / Ring / Regenerative / Lateral Channel Type Blower

OPERATING PRINCIPLE :

The lateral channel blowers-exhauster (SCL) have been developed on the theory of the regenerative flow.
Radial blades on the impeller draw air from the inlet port and drive it outward and forward into channels that return it to the blade’s base. The result, based on both impeller/blade design, as well as housing configuration and relationship to the impeller, typically yield greater continuous operating pressure/ vacuum than most regenerative blower designs or, conversely, at the same pressure or vacuum, greater air flow.
Due to their unique principle of operation and design, there is no contact between rotating and stationary parts.
The main advantages are the following:

- no wearing parts
- no lubrication required
- minimum maintenance
- silent operation
- smooth air flow.

Exhaust air is clean and pulsation-free, owing to the non-positive displacement, oil-less design. Open flow capabilities range up to 2000 m3/h, with maximum *continuous* (i.e. 24
- manufacturing material is the aluminium alloy

TECHNICAL DATA:

The data provided refer to the handling of air at 20°C and 1013 mbar (abs) atmospheric pressure absolute pressure of 1013 mbar - at the suction port when operating as a compressor, at the discharge port when operating as a vacuum pump-
The data can change in accordance with the following factors:

- any variation in absolute outlet pressure of 1013 mbar (suction);
- any variation in absolute inlet pressure of 1013 mbar (discharge);
- operation using inlet/outlet simultaneously (back pressure at discharge port and suction at the inlet port)
- handling of fluid having different density from 1.2 kg/m3;
- variation in speed of rotation in relation to the basic one (2900 rpm–50 Hz and 3500 rpm–60Hz.).

ACCESSORIES:

FPZ also design and produce special blowers for the handling of gases having high pressure and temperature, or specialty/corrosive composition, by incorporating specific materials including special surface treatments and use of different seal types.
Particularly a dedicated range was developed:

FPZ effepizeta®

F.P.Z. effepizeta srl
via F.lli Cervi 16-18
20049 Concorezzo (Milan), Italy
Tel +39 039 6041820
Fax +39 039 6041296
info@fpz.com

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2008 SINCERT DNV

Explosion Proof Package

Small Bely Drive Package

Direct Couple TMD Package

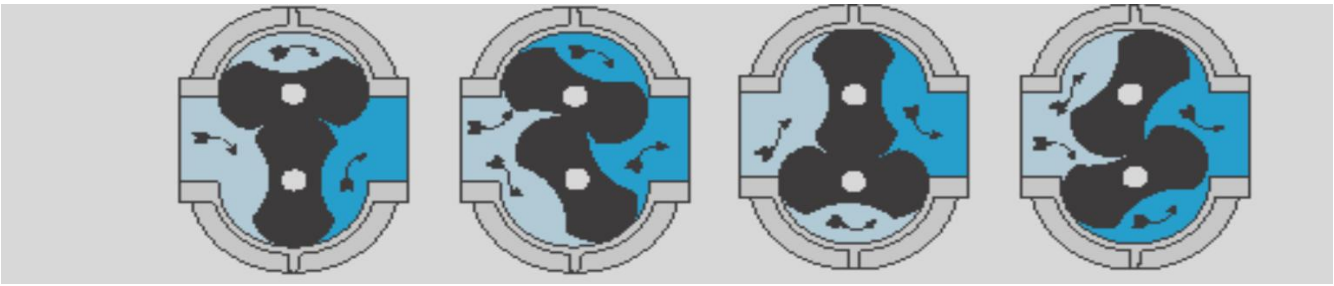
ATEX Classification Package

Roots / Positive Displacement (PD) / Rotary Type Blower

URAI-G small gas blower

RAMG-J medium size gas Blower

RGS-J Large size gas blower



Rotary Positive Blower Principle of Operation

Two figure-eight lobe impellers mounted on parallel shafts rotate in opposite directions. without

As each impeller passes the blower inlet, it traps a finite volume of air and carries it around the case to the blower outlet, where the air is discharged. With constant speed operation the displaced volume is essentially the same regardless of pressure, temperature or barometric pressure. Timing gears control the relative position of the impellers to each other and maintain small, but defined, clearances. This allows operation lubrication being required inside the air casing.

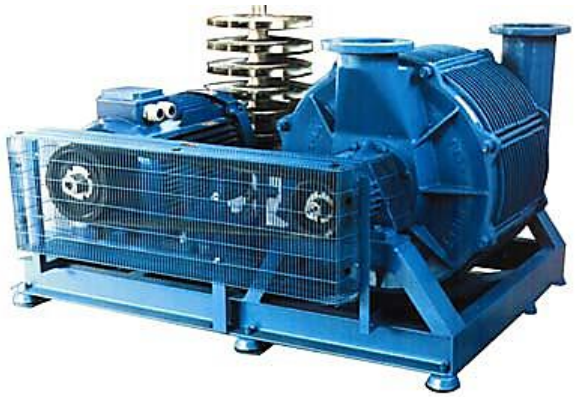
Belt Drive Package Gas Blower

Direct Couple Package Gas Blower

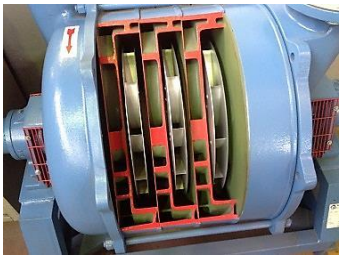
The original ROOTS blower still leads the way.™

Roots

GE Energy
Houston, Texas Headquarters | U.S. Toll Free Phone: 1 877-363-ROOT(S) (7668) | Direct Phone: +1 832-590-2600
Connersville, Indiana Operations | Direct Phone: +1 765-827-9200
Waukesha, Wisconsin Operations | Direct Phone: +1 262-650-5965



Multi Stage Centrifugal Type Blower

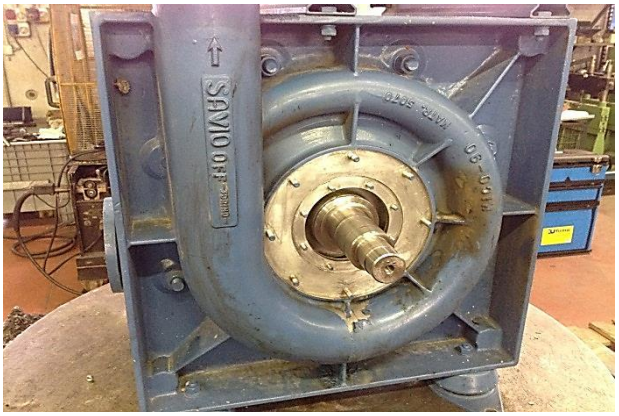


Internal Parts / Impeller / Drum (housing) / Static part

SAVIO S.r.l. AIR TECHNOLOGY

ATEX

Stainless Steel Shaft in ATEX version



SAVIO S.r.l.
TECNOLOGIA DELL'ARIA

Via Reggio Calabria,13 – Cascine Vica Rivoli (TO) Italia
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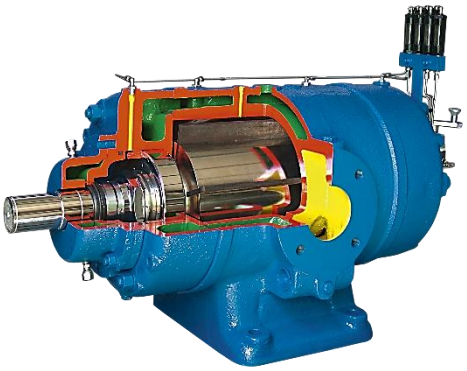
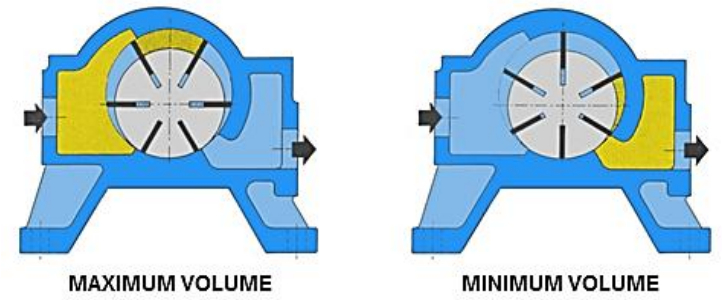
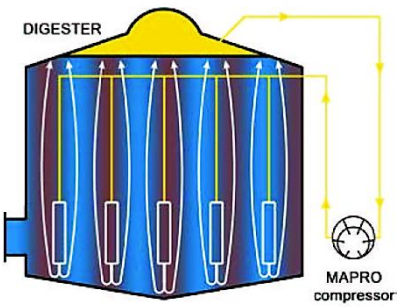
E-mail : savio@savioclima.it http:// www.savioclima.it

Rotary Vane Gas Compressor





General Function Description of Rotary Vane Gas Compressor



Standard Direct Couple Package for Biogas Digester Tank Stirring

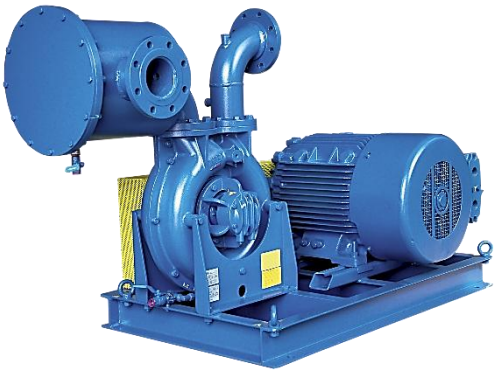
MAPRO INTERNATIONAL SpA
Macchine Pneumatiche Rotative
Via Vesuvio, 2
20834 NOVA MILANESE (MB) – Italy
Tel. +39 0362 366 356
Fax +39 0362 450 342
www.maproint.com - E-mail:
mapro@maproint.com

Special Direct Couple Package for Chemical Process Line

First “Mapro” Rotary vane Gas Compressor In Thailand for Palm Oil Bio-gas Plant

Special Material , Rotary Vane Gas Compressor Blade for Corrosion Resistant

The Peripheral Toroidal Chanel Blower



Turbotron Blower

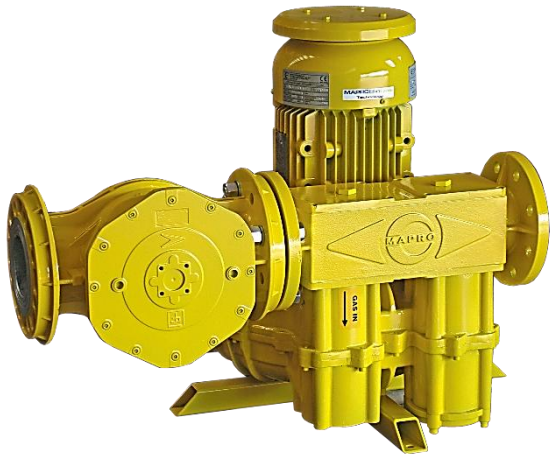
Very Special Designed of both Rotor & Housing

*The **Turbotron** **R** is a machine with a peripheral toroidal channel similar to side channel blowers, but with a revolutionary heliflow impeller and channel developed through long research and tests. With this impeller and channel design, performances similar to positive displacement machines can be achieved, with none of the associated problems and, indeed, with some added advantages:*

- *quiet operation (10÷15 dB less than a positive displacement machine);*
- *vibration free;*
- *pulsation free;*
- *oil free;*
- *low maintenance (inlet filter cleaning and occasional greasing of the bearings only).*

Bearing replacement can be carried out without disassembling the machine casing. In the Turbotron R design, the aspirated gas is forced along the two peripheral channels in parallel, or, by modifying the inlet and outlet porting, one of the channels can be excluded thus obtaining a machine (Turbotron RHF) with half the flow rate at the same outletpressure.
Because of the wide range of permissible operating speeds of rotation (from 2000 to 5500 rpm), a very large operating range can be achieved using a single machine size.
The casing and impeller are made from aluminium alloy and the shaft from alloy steel.
By using different types of shaft sealing, most industrial gases as well as natural and biological gases can be handled. In the case of corrosive gases, the internal wetted parts can be treated or lined with protective coatings.

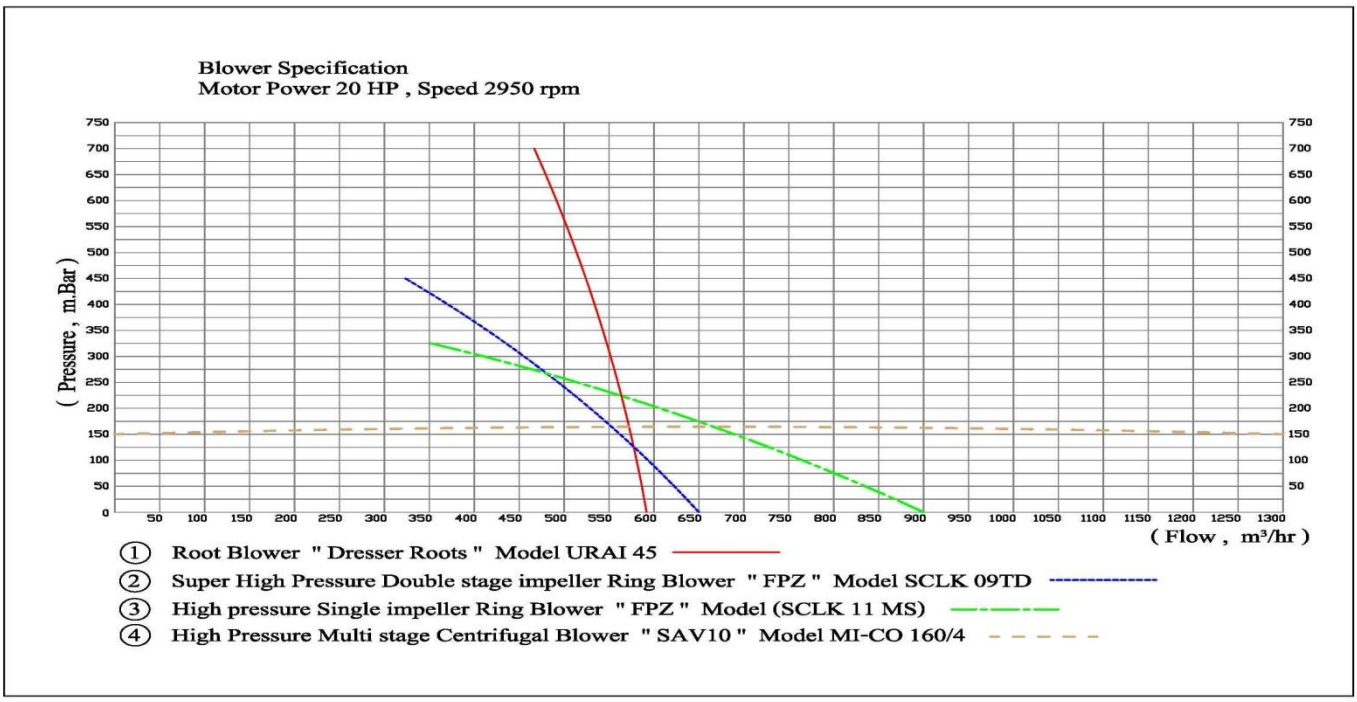
Belt Drive Upside Down Blower Package to avoid the water trap



Ring Blower with Pressure Control by pass Valve

MAPRO BioGas Technology

The Comparison Characteristic Graph between 3 Types of Blower



Guide line table for air & gas compression machine selection

Aircompressionmachine (เครื่องอัดลม)	Compressed method	Max Pressure (mm.H2O)	Max.speed (rpm)	Flow control equipment	Zero Flow operating
High press.centrifugal	Centrifuse	+1000	4000	Valve	Allow
Extra high press. centrifugal	Centrifuse	+15000(1.5 bar)	10000	Valve	Allow
Multi-stage centrifugal	Centrifuse	+20000(2 bar)	5000	Valve	Allow
Ring (Side chanel)	Regenerative	+8000	5000	Valve & FrequencyInverter	Not allow
Roots (Rotary)	Positive Displacement	+20000(2 bar)	5000	Frequency Inverter	Not allow/ Verry dangerous
Rotary Vane	Positive Displacement	(10 bar)	3000	Frequency Inverter	Not allow/ Verry dangerous

***Max values in this table are asuumed from the common available items in market.**

***Please check wit your supplier before making any decision.**

Volume & Pressure Convertion table

Volume (rate of flow)

m³/hr	x 0.5886	= cfm	x 1.699	=	m³/hr
m³/hr	x 35.31	= cfm	x 0.0283	=	m³/min
l/min	x 0.06	= m³/hr	x 16.67	=	l/min
l/min	x 0.03532	= cfm	x 28.31	=	l/min

Gas condition

	sing	Temp	Pressure
Standard	S	68 ℉	14.7 PSI
Normal	N	0 ℃	1013 mbar
Actual	A	Ambient	Ambient

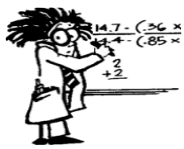
Pressure (static)

	psi	In. Hg	In.H2O	Kgf/cm³	mbar	kPa	mm.Hg	mmH₂0
psi	1	2.036	27.68	0.07	68.95	6.895	51.71	703.1
In.Hg	0.4911	1	13.6	0.035	33.86	3.386	25.4	345.3
In.H2O	0.03613	.07356	1	0.003	2.491	0.2491	1.868	25.4
Kgf/cm³	14.22	28.96	393.7	1	980.7	98.07	735.6	10000
mbar	0.0145	0.02953	0.4015	0.001	1	0.1	0.7501	10.2
kPa	0.145	0.2953	4.015	0.01	10	1	7.501	102
mm.Hg	0.01934	0.03937	0.5352	0.001	1.333	0.1333	1	13.6
mm.H2O	0.001422	0.02896	0.0394	1E-04	0.9807	0.00981	0.7356	1

$$ACFM = SCFM \times \frac{Ps-(RHs \times PVs)}{Pb-(RHa \times PVa)} \times \frac{Ta}{Ts} \times \frac{Pb}{Pa}$$

Where
Ps = Standard pressure (PSIA)
Pb = Atmospheric pressure – barometer (PSIA)
Pa = Actual pressure (PSIA)
RHs = Standard relative humidity
RHa = Actual relative humidity
PVs = Saturated vapor pressure of water at standard temperature (PSI)*
PVa = Saturated vapor pressure of water at actual temperature (PSI)*
Ts = Standard temperature (˚R) NOTE: ˚R = ˚F+460
Ta = Actual temperature (R)

***See Chart on page 12**



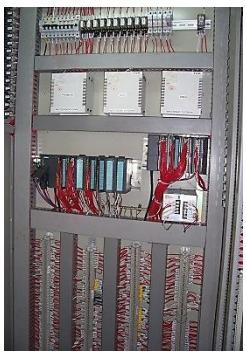
$Nm^3/hr = SCFM \times 1.583$

Engineering Work




Installation & Piping Work



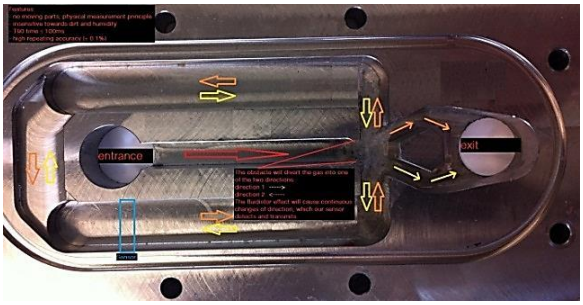

Electrical control work / PLC / SCADA system

Oscillating Biogas Flow Meter

Stainless Steel Oscillating Gas Flow Meter

Intelligent Flow Computer Module

Gas Validation Flow Meter



Oscillating Principle of Measurement

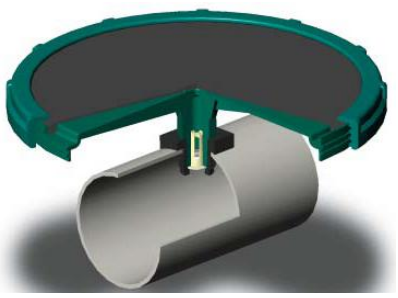
Esters Elektronik GmbH
Otto-Hahn-Str. 2 D-63110 Rodgau
Phone: +49 (6106) 3040
Telefax: +49 (6106) 1 81 92
e-Mail: vertrieb@esters.de

Membrane Air & Gas Diffuser

Membranes are not just rubber parts

Using his experience based on Automotive and Machine Tool industry he engineered custom designed disc and tube type diffusers for almost every German and US OEM waste water company.
Since 1975 Gummi-Jager sold more than 10 Million membranes and diffuser assemblies. As pioneer in the industry Arnold Jager innovated the diffused air wastewater treatment and created more than 30 diffuser related patents.

Test every production lot

JetFlex Disc Diffuser - HD 270 FO53 J27

Jager Umwelt-Technik GmbH & Co. KG
Rothwiese 4
30559 Hannover, Germany
Phone: (+49)511 898668-0
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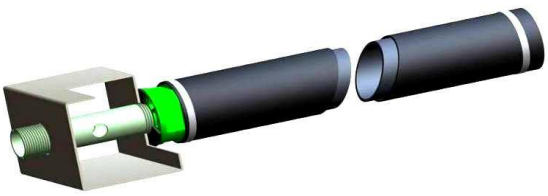
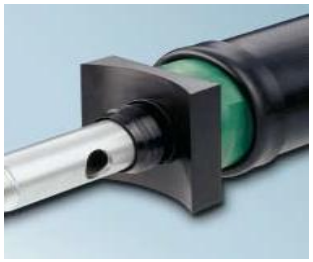
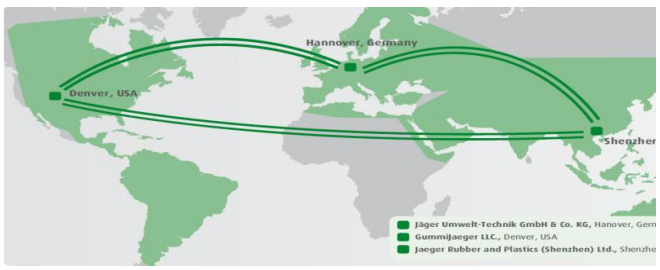




JetFlex Tube Diffuser - TD 63 EPDM performance J34

Choices of connections Three Manufacturing bases

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