

‘No Air - No bottle’



Lyon, 7 May 2015

Rotary Vane Technology for Vacuum pumps and Air Compressors

Daniel Hilfiker
Pneumofore - Italy

www.pneumofore.com

Pneumofore



- **since 1923**
- **3 Generations of Swiss ETH engineers**
- **Worldwide references**
- **Vacuum up to 6400 m³/h with 220 kW**
- **Compressors till 2400 m³/h with 2,5 to 12 bar(g) and 315 kW**



Options and features of our compressors and vacuum pumps

- . Machines ready-to-use
- . Electro-pneumatic control as standard
- . Electronic, digital, remote control as option
- . Simple ordinary maintenance
- . Highest efficiency
- . Easy repair / overhaul
- . Variable Speed for constant pressure / vacuum
- . Hot Climate version for air cooling up to 50°C
- . Heat Recovery systems
- . Lowest Total Ownership Cost

Reference List - GLASS INDUSTRY - Extract

PORTUGAL
BA Vidro

SPAIN
O-I Biorra
Vidrala Alcala Vidrio
Vidrala Crisnova Vidrio
Vidriera de Atlantico

FRANCE
O-I Vayres
O-I Vergeze
SGD Sacy-en-Brie
Veralka Chaux-sur-Saone
Veralka Cullies
Veralka Lagnieu
Verretrie Ilrossé

BELGIUM
Gesheheimer Montignies

UNITED KINGDOM
Allied Glass

GERMANY
SGD Pipfenberg
Wiegand Gresselsteinbach
Wiegand Steinbach am Wald

POLAND
BA Vidro Jelfice
BA Vidro Sierakow
Can Pack Orzesze
Heinz Glass Dzialdowo
Huta Szkla TUR
O-I Antoninek
Storzle Crestochowa
Stoezle Wymiaris
Vitrosilicon Ilowa

ITALY
Bormioli
O-I Aprilia
O-I Asti
O-I Bari
O-I Castellana Grotte
O-I Marsala
O-I Mezzocorona
O-I Druggio
O-I Ottaviano
O-I San Gemini
O-I San Polo di Piave
O-I Villotta di Chiomonte
Seves
VEBAD
Veralka Dege
Veralka Gazzo Viteronese
Veralka Longo
Veralka Pesera
Veralka Swigliano
Veralka Villa Poma
Vetrena di Borgonovo
Vetrena Etrusca
Vetrena Piegarese
Vetro Speciale
Vetro Aredo
Vetro Balsamo
Vidrala Casico
Zignago Vetro

BULGARIA
Dituba Glassworks

CZECH REPUBLIC
O-I Nowe Sedlo
Sklarny Moravia
Vitrabik

ESTONIA
O-I Jarvalandi

RUSSIA
9th January Glass
Arbis
Alekseevskoye Steklo
Balshtunskoye Glass
Chagodoshenskoy Glass
Dagestani Glass
Dmitrov Glass
Fakel Glass
Kingssepp Glass
Lipetsk Glass
Misheron Glass
Ornsk Steklotara
Ornsk Container Glass
OZSK Spirsko
OZSK Yoshkar-Ola
Perifara
Rizavovskiy Glass
Sisecam / Biscam
Stekloteli
Svet Glass
Tver Glass
Velkodorosky Glass
Veralka Kamyshev
Veralka Karminsteklo
Vip Glass

BELARUS
Belstehkoproem

UKRAINE
Bucharsky Glass
Kostopolsky Glass
Malkovskiy Glass
Pobitryvskiy Glass
Veralka Rbne
Vetropack Gostomel
Vokrogorsk Glass
Youla Glass Burcha

ARMENIA
Glass World Company

AZERBAIJAN
Infer Glass

MOLDOVA
Cristal Flor
Fabrica de Sticla din Chesnau

SERBIA
Sepska Fabrika Stakla

TURKEY
Lav
Marmara Cam
Park Cam
Sisecam Eskisehir
Sisecam Mersin
Sisecam Yensehir

SAUDI ARABIA
Mamhood Saeed
Zoujaj Glass

KUWAIT
Gulf Glass Manufacturing

UAE
Albajir

IRAN
Nafis Glass
Shah' Va Gas
Takeshan Glass
Zabsan Glass

SIRIA
Modern Company

EGYPT
Cedar Glass
Kandil Glass
Middle East Glass
Mir Glass
National Glass
Pearl Glass

ALGERIA
Alber

MOROCCO
Sivam

TUNISIA
Solmir

ANGOLA
Vidrol

ETIOPIA
Aduglass

NIGERIA
Fignerglass
Glassforce

ZIMBABWE
Zimbabwe Glass Ind.

SOUTH AFRICA
Consol Glass
Nampak Glass

INDIA
AGI Glassco
HNIG-Bahadurgarh
HNIG-Handapeta
HNIG-Nashik
Pramal Jambisar
Pramal Kosamba
Vitram Glass

SRI LANKA
Ceylon Glass

VIETNAM
O-I BIC

INDONESIA
Mulla Glass

MALAYSIA
O-I BIC

THAILAND
Bangkok Glass-Ayuthaya
Bangkok Glass-Prachinburi
Lighting Glass
Wellgrow Glass

CHINA
Qina Changyu Glass
Yantai Changyu Glass

TAIWAN
Ura President Glass

USA
Gallo Glass Company



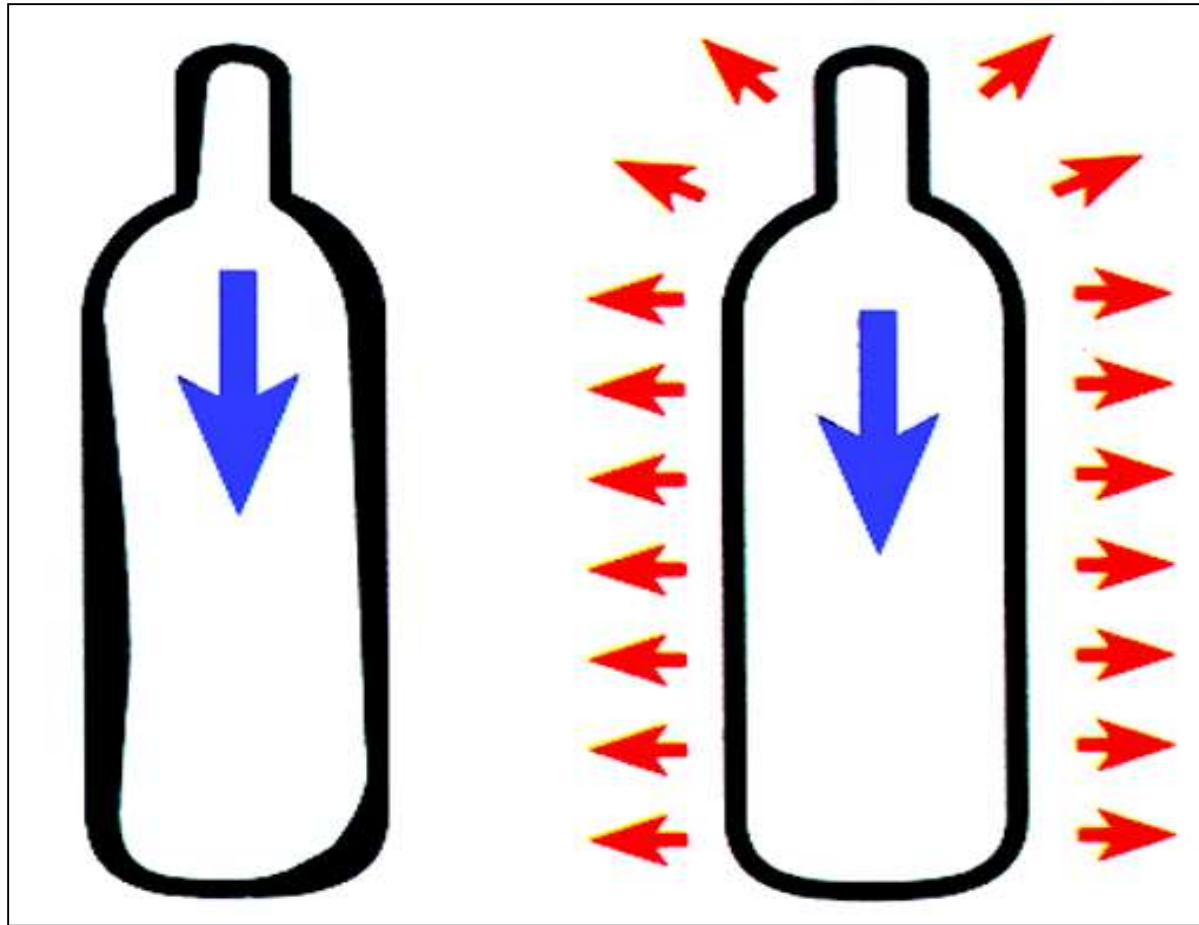
Pneumofore

SINCE 1923

SWISS ENGINEERING
ITALIAN DESIGN
GLOBAL PRESENCE

ISO 9001
ISO 14001
CERTIFIED

How does the bottle behave in the mould?



**Compressed
air only**

**Compressed air
with vacuum**



**These two beer
bottles have the
same capacity:**

0,66 liters

But do not have the same weight

522 gr.



283 gr.



Targets

- 1. reduce energy consumption**
- 2. eliminate use of water**
- 3. improve vacuum level**
- 4. keep the system flexible**

Solutions

- a. heat evacuation > higher speed > more bottles/min**
- b. precise molding > higher quality > less rejection rate**
- c. lighter weight > less glass required > reduced production cost**



MGM
Sabbato

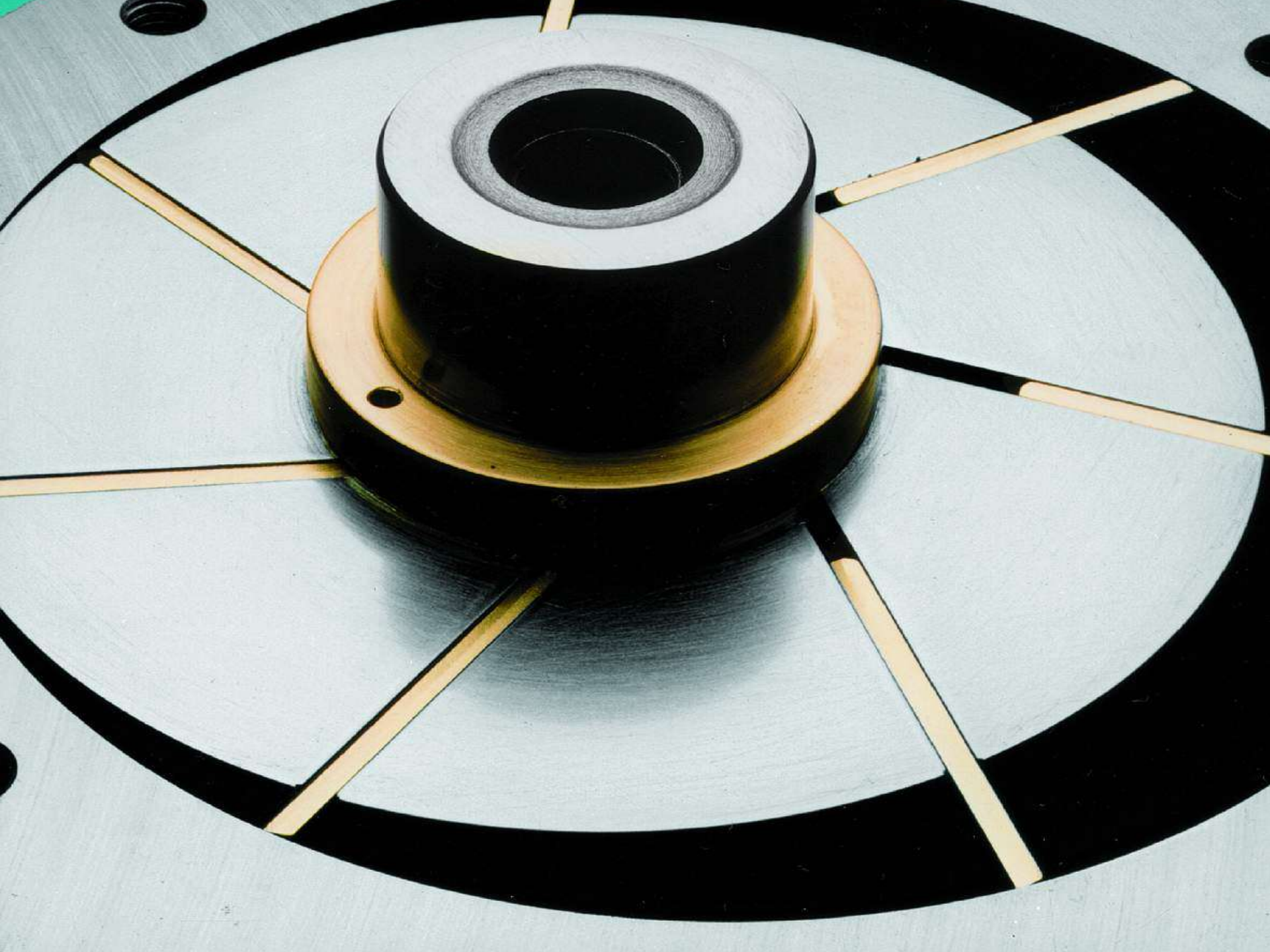
Case Study

Hindustan National Glass

Bahadurgarh Plant, 3 Furnaces
14 IS lines, 158 sections in total
10 x UV50 VS90 HC rotary vane pumps
Air Cooling, Variable Frequency Drive
900 kW installed power

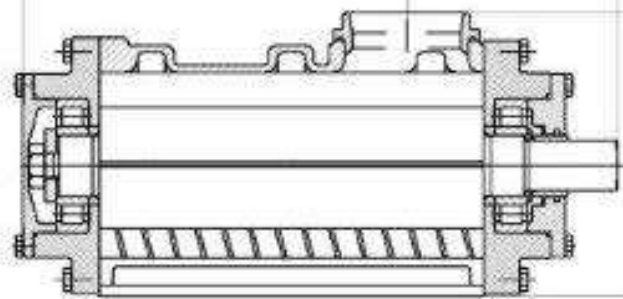
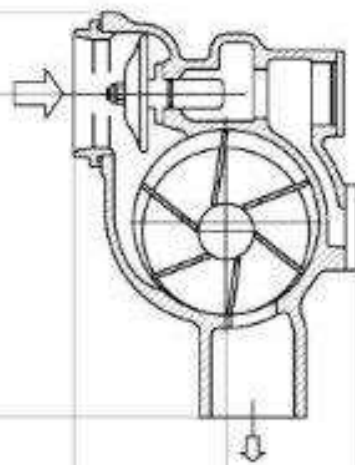
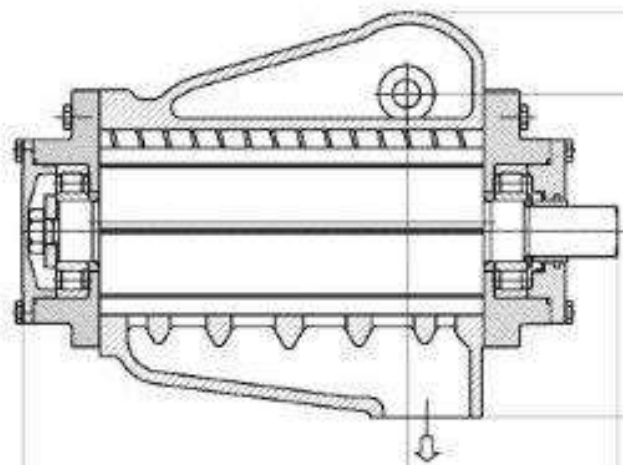


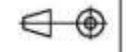
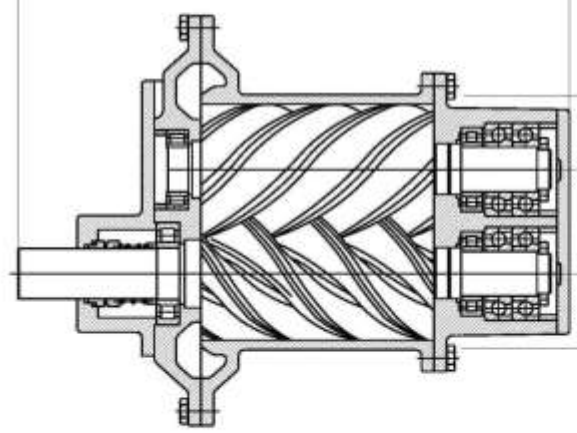
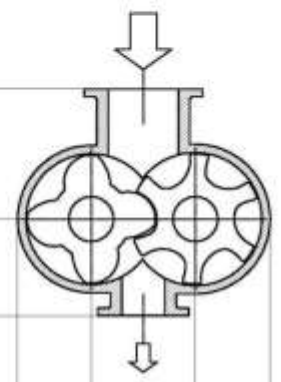
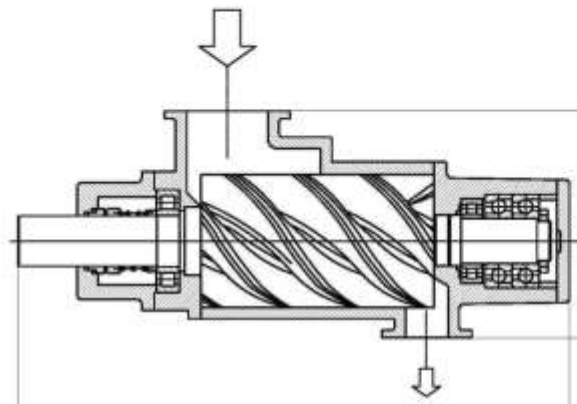




overhauling of a 40 years old rotary vane compressor









Compressor or Vacuum Pump

Vane

Screw

Sealing

active

passive

Bearings

2 x big

6 x small (or more)

Rotation speed

1450 rpm

1450 to 6000 rpm

Life time

30 years

3 years

Efficiency

constant

minor in time

Coupling

direct

mostly gearbox

Temperature

110°C

200°C

Repair

yes, easy

limited, impossible

Life Cycle Cost

lowest

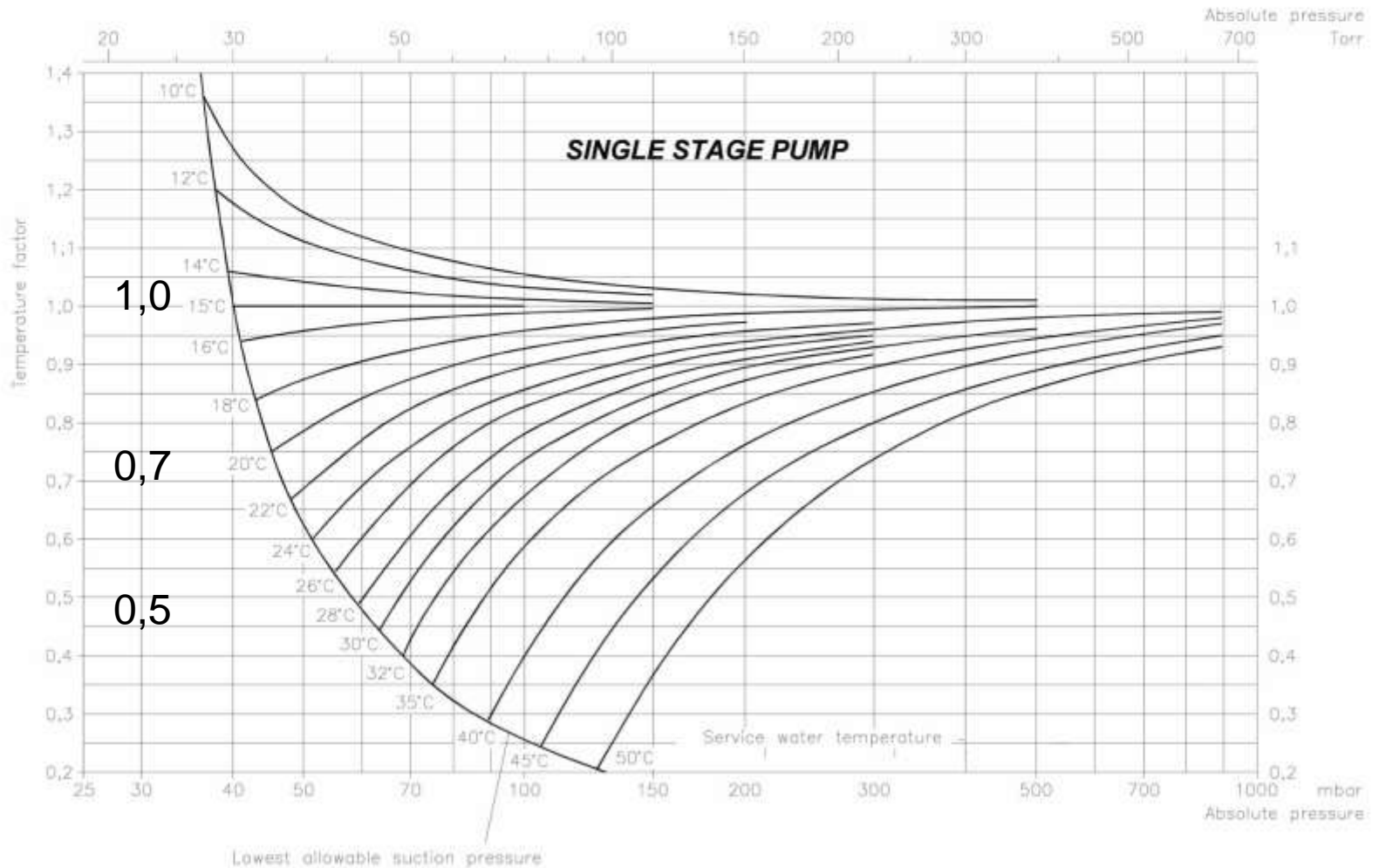
high





**Liquid ring vacuum pump
Foundation. Belt drive. No power panel.
Water ring. Piping. Noise, no cabin.**

EFFECT OF SERVICE LIQUID TEMPERATURE ON THE CAPACITY OF LIQUID RING VACUUM PUMPS



15°C

1,0

20°C

0,7

28°C

0,5



- **Water cooling system**
- **Heat exchanger**





- **Water cooling system**
- **Cement foundation**
- **Cooling tower**
- **Water pumps**
- **Piping**
- **Water integration**
- **Water treatment**
- **Chiller**

COMPARATIVE ANALYSIS between liquid ring VACUUM PUMP and oil lubricated rotary vane UV50



Comparison of running costs between 1 liquid ring vacuum pump with water recovery with 110 kW installed power and 1 Pneumofore vacuum pump mod. UV50 with 75 kW installed power.

Liquid ring solution: 1 liquid ring vacuum pump with 35°C service liquid temperature, with water recovery, with 110 kW installed power. Absorbed power at 200 mbar(a) of 98 kW, capacity at 200 mbar(a) of 2.580 m³/h.

Pneumofore solution: 1 rotary vane oil lubricated air cooled Pneumofore vacuum pump mod. UV50 with 75 kW installed power. Absorbed power at 200 mbar(a) of 60,6 kW, capacity at 200 mbar(a) of 2.641 m³/h.

	Measure unit	Liquid ring solution	Pneumofore solution	Calculus
Working hours per year	h/year	8.000		A
Pump lubricant quantity	liters	0	70	
Lubricant consumption	liters/h	0	0	
Lubricant cost	€/liter	0	9,35	
Water consumption	m ³ /h	1,3	0	B
Water cost	€/m ³	0,8	0	C
Water cost every 8.000 hours	€/year	8.320	0	X = A x B x C
Manpower	h/day	0,1	0,05	D
Manpower cost	€/h	20	20	E
Manpower cost every 8.000 hours	€/year	667	333	Y = D x E x A/24
Energy cost	€/kWh	0,1	0,1	F
Power consumption of the cooling tower fans and water circulating pump	kW	4	0	G
Power consumption at 200 mbar(a)	kW	99	60,6	H
Energy cost every 8.000 hours	€/year	92.400	48.480	Z = A x F x (G + H)
Running cost (water, manpower, energy)	€/year	91.387	48.813	K = X + Y + Z
Saving every 8.000 hours	€/year	0	42.573	N = ΔK
Spares and maintenance costs every 8.000 hours	€/year	1.450	4.560	M
Total saving every 8.000 hours	€/year	-	39.463	R = N - ΔM

Note:

1. Are considered 8.000 working hours and 2 ordinary maintenances for UV50.
2. **Water, energy and manpower costs are typical**

Conclusions:

1. The **total yearly saving**, with replacement of the existing pumps with Pneumofore UV50, is **€ 39.463**
2. Considering the price of 1 x UV50 with some standard accessories of € 65.700, the ROI (Return Of Investment) is **1,7 years**
3. Considering **10 years** running of 1 x UV50, the saving is **€ 328.930**

Power Savings

If saved power is 100 kW for 8600 h/year,
thus 860.000 kWh @ 0,1 euro/kWh,
yearly saving is
86.000 euro

Environment

If saved power is 100 kW, 8600 h/year
and 0,5 kg of CO₂/kWh,
the yearly CO₂ emission is reduced by
 $100 \times 8600 \times 0,5$
430.000 kg



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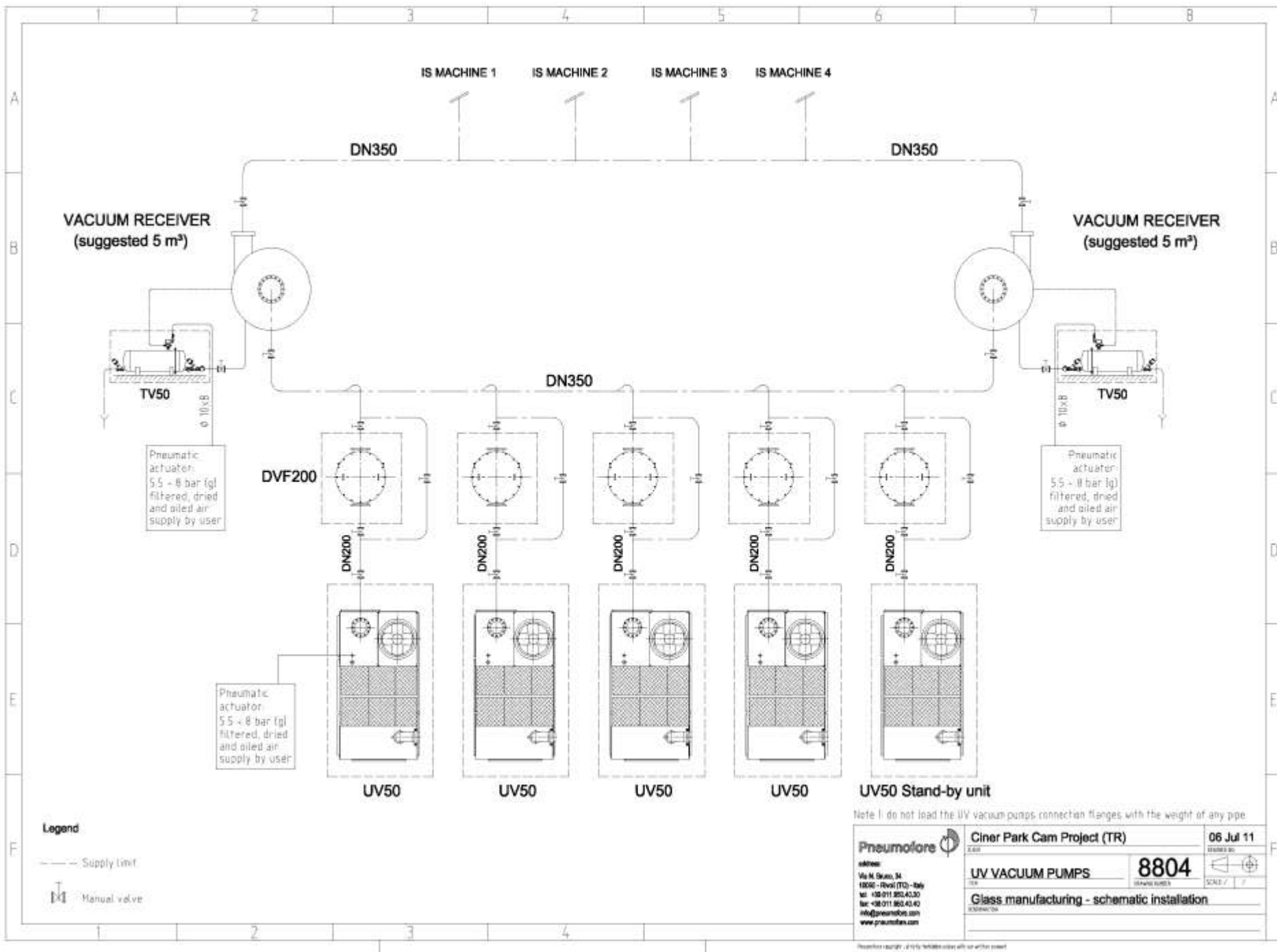
UV

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UV

Pneumofore

UV



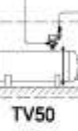
IS MACHINE 1 IS MACHINE 2 IS MACHINE 3 IS MACHINE 4

DN350

DN350

VACUUM RECEIVER
(suggested 5 m³)

VACUUM RECEIVER
(suggested 5 m³)

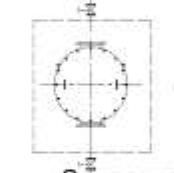
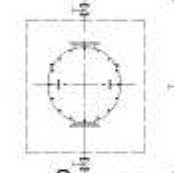
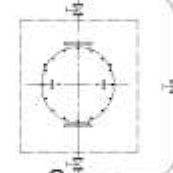
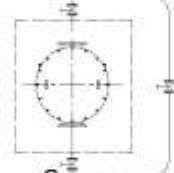
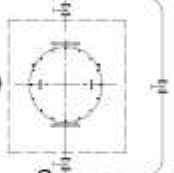


Pneumatic actuator:
5.5 - 8 bar (g) filtered, dried and oiled air supply by user

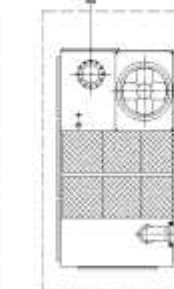
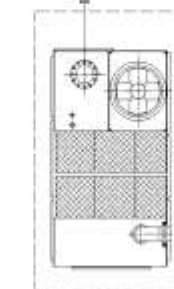
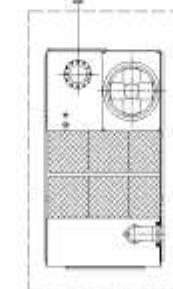
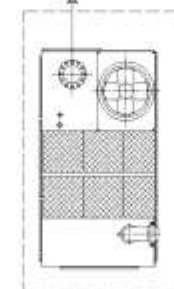
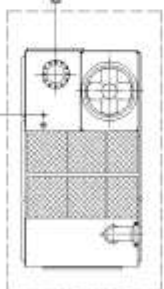
Pneumatic actuator:
5.5 - 8 bar (g) filtered, dried and oiled air supply by user

DVF200

DN350



Pneumatic actuator:
5.5 - 8 bar (g) filtered, dried and oiled air supply by user



UV50

UV50

UV50

UV50

UV50 Stand-by unit

DN200

DN200

DN200

DN200

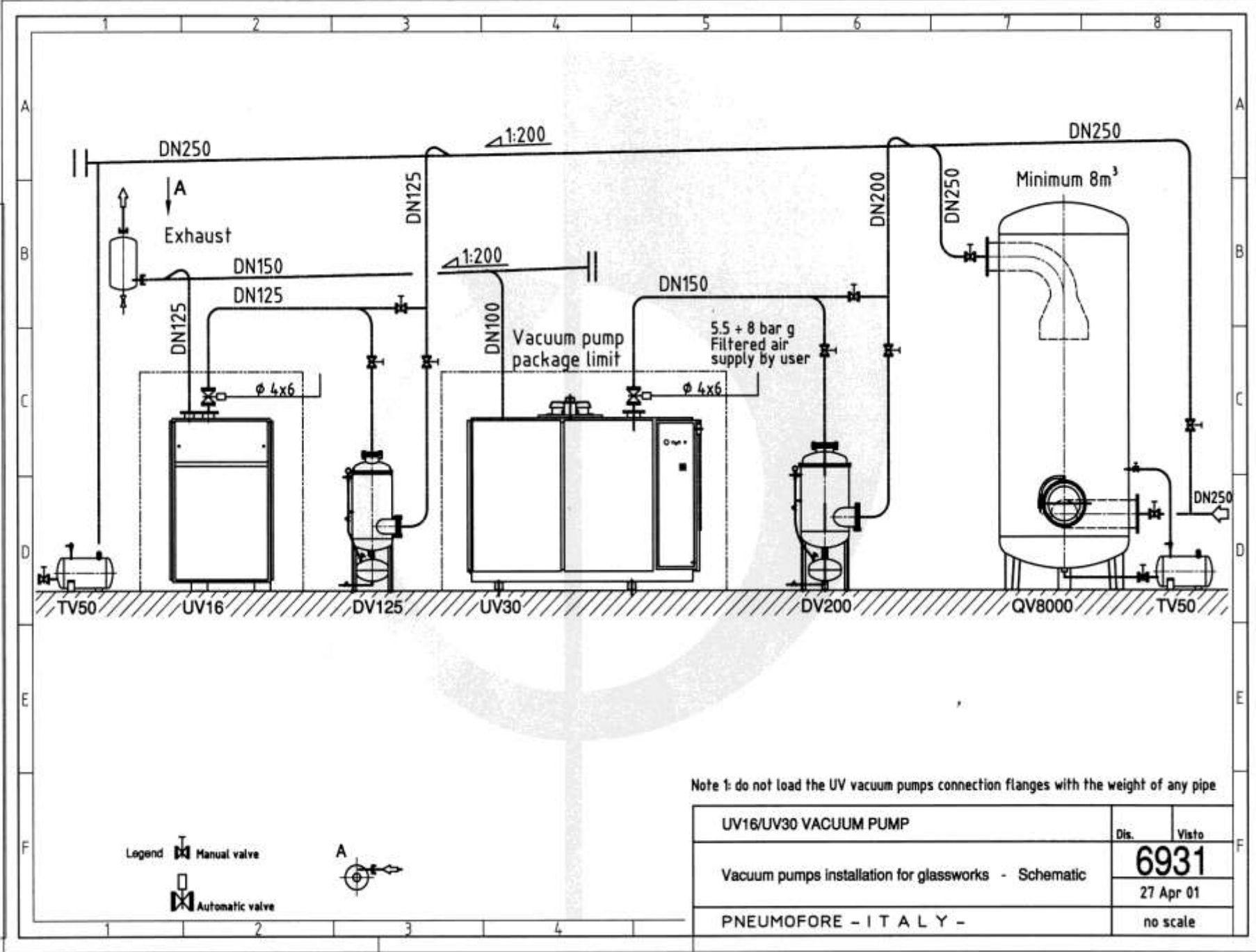
DN200

Legend
 Supply limit
 Manual valve

Note 1: do not load the UV vacuum pumps connection flanges with the weight of any pipe

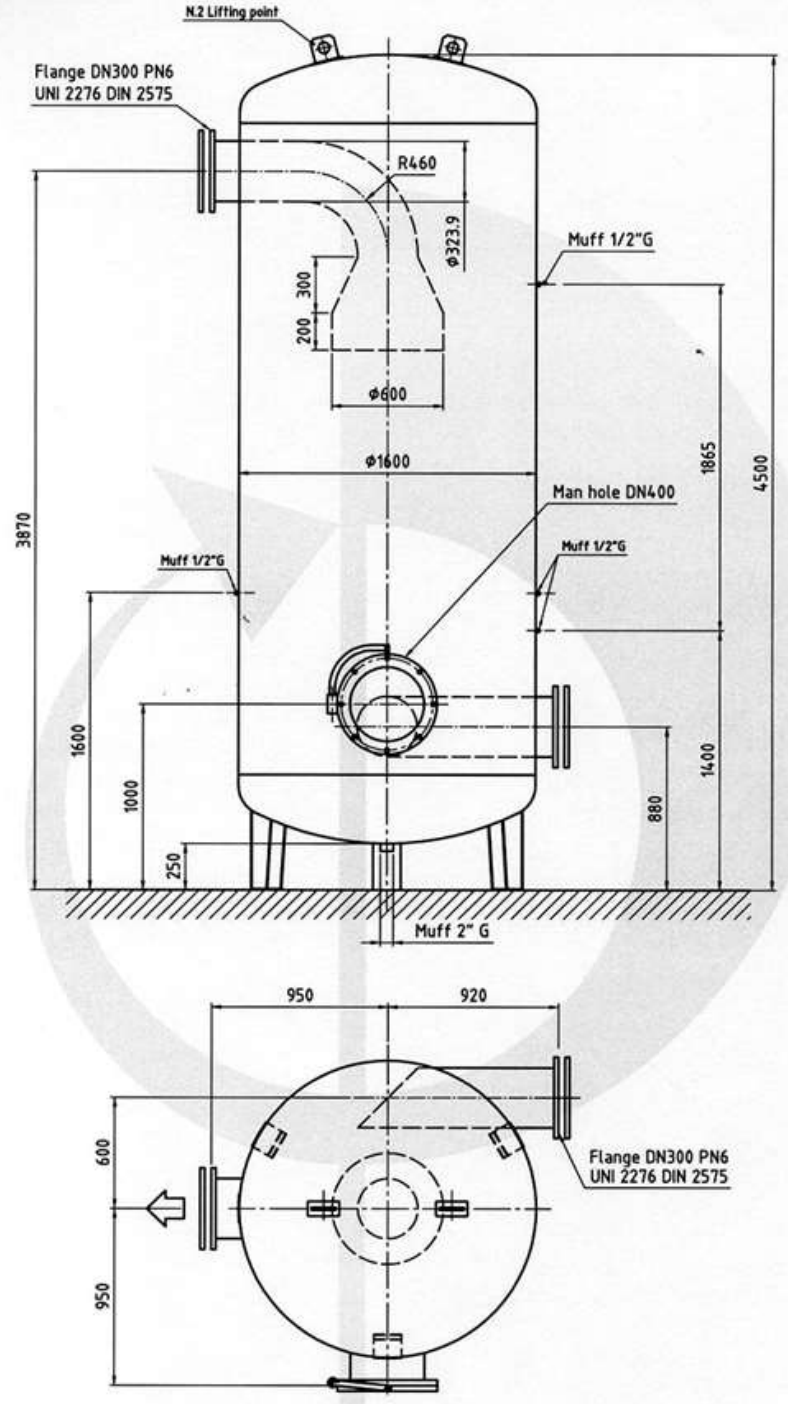
Pneumofore address: Via M. Sacco, 34 10090 - Rivoli (TO) - Italy tel: +39 011 852.43.30 fax: +39 011 852.43.40 info@pneumofore.com www.pneumofore.com	Ciner Park Cam Project (TR) 8804 <small>REVISIONI</small>	06 Jul 11 <small>STATUS</small>
	UV VACUUM PUMPS	
	Glass manufacturing - schematic installation <small>ESPRESSO</small>	<small>SCALE</small> / /

Reservare il diritto di modificare senza preavviso



Note 1: do not load the UV vacuum pumps connection flanges with the weight of any pipe

UV16/UV30 VACUUM PUMP	Dis.	Visto
Vacuum pumps installation for glassworks - Schematic	6931	
	27 Apr 01	
PNEUMOFORÉ - I T A L Y -	no scale	



UV Series Vacuum Pumps for IS machines metric

Model	UV16	UV16 VS30	UV30	UV30 VS55	UV50	UV50 VS90
Nominal Power [kW]	22	30	45	55	75	90
Absorbed Power at 150 mbar(a) [kW]	19	13 + 23	40	28 + 47	59	41 + 70
Flow at 150 mbar(a) [m ³ /h]	947	663 + 1117	1699	1189 + 2005	2620	1834 + 3092
DG Sections	8	6 + 10	15	10 + 17	22	15 + 26
TG Sections	6	5 + 8	12	8 + 14	18	12 + 22

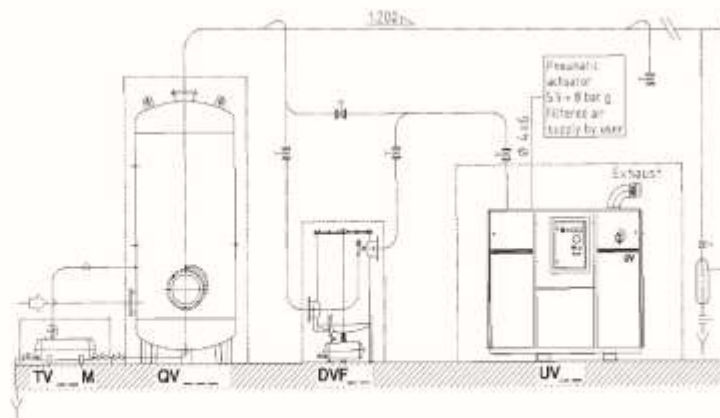
Note:

1. Considering **120 m³/h/section** for DG and 150 m³/h/section for TG at 150 mbar(a). Vacuum forming depends on mold size design, wear and timing too.
2. UV Pumps are **air cooled**, also for tropical climate (**HC version up to 55°C**) with a larger size electrical motor. Option of water cooling available with **W version**.
3. Delivery is usually **4 weeks**. Machines with **VS** variable speed, special **PLC control** or electrical components or voltage have longer delivery.
4. Units are **ready-to-use**, main power switch is on-board, no foundation requirement. Air cooling requires a well ventilated environment.
5. **Constant efficiency** over 100.000+ hours of continuous operation with long service intervals.
6. Designed to **run 12+ years**, without overhauling, as per furnace life span.
7. System design with all **pipng calculation** is a free service of Pneumofore to guarantee proper trouble-free production.
8. Correct vacuum will reduce the container weight, **increase the moulding speed** and reduce the rejection rate with minimal operational costs.



UV50

UV16



Approach

**Life Cycle Cost / Total Cost of Ownership
calculations**

Return on Investment

Before / After data collection

Summary

- Rotary vane technology for compressed air and vacuum based on 90 years of experience
- High capacity, high efficiency, air cooling up to 50° C.
- Important cost savings, replacement of screw and liquid ring machines with ROI of as low as 18 months

Pneumofore



End of the Presentation

Thank you for your attention