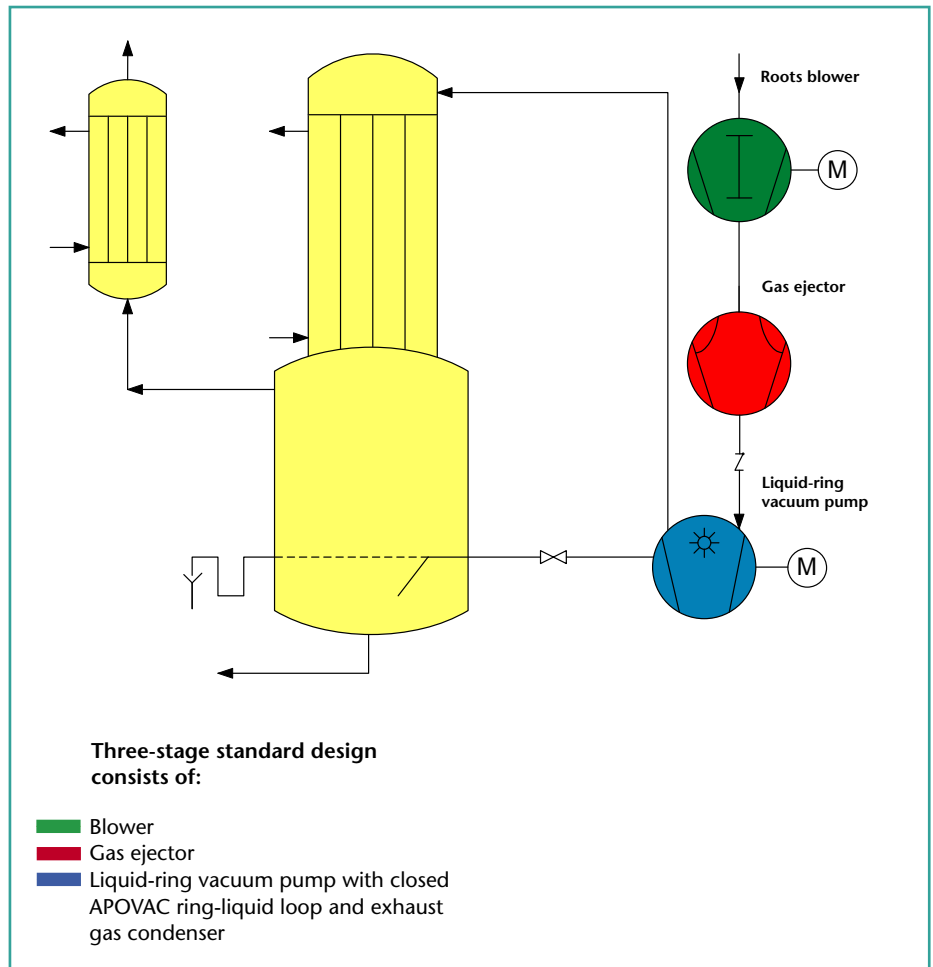


COMBIVAC[®]
Vacuum Systems

to evacuate gases and vapours
at low suction pressures



The COMBIVAC® is a multi-stage vacuum system. It was developed based on the APOVAC vacuum system to achieve oil-free and economical compression of gases and vapours at low suction pressures (< 6 mbar abs.). In a COMBIVAC vacuum system a roots-blower is foreseen before the gas ejector and liquid-ring vacuum pump. In combination with a closed ring-liquid loop (APOVAC) it is possible to use condensate from the process.



Description of the Vacuum System

Roots blowers are volumetric vacuum pumps operating according to the so called roots principle. Two lobes in the shape of an "8" rotate in opposite directions without touching each other. The gas is transported vertically downwards through the pump. In the COMBIVAC design, roots blowers are used as primary pump upstream of the liquid-ring vacuum pump (with or without gas ejector), because of their high suction capacity and their ability to reach an end vacuum below 1 mbar absolute.

A 3-stage COMBIVAC system has a gas ejector as a second stage between the roots blower and the liquid-ring vacuum pump. The motive gas required for the ejector operation comes from the ring-liquid tank of the APOVAC system. COMBIVAC systems without a closed ring-liquid loop use mainly air from the atmosphere as motive gas. The utilisation of a gas ejector ensures in addition a constant supply of minimum inert gas to the liquid-ring vacuum pump and thus preventing cavitation.

Performance Curves of Standard Types

Standard types:

Suction capacities from 150 to 2000 m³/h.
Working pressures down to 0.5 mbar abs.
Attainable suction pressure 0.1 mbar abs.
Service temperatures from -30 °C to 110 °C.

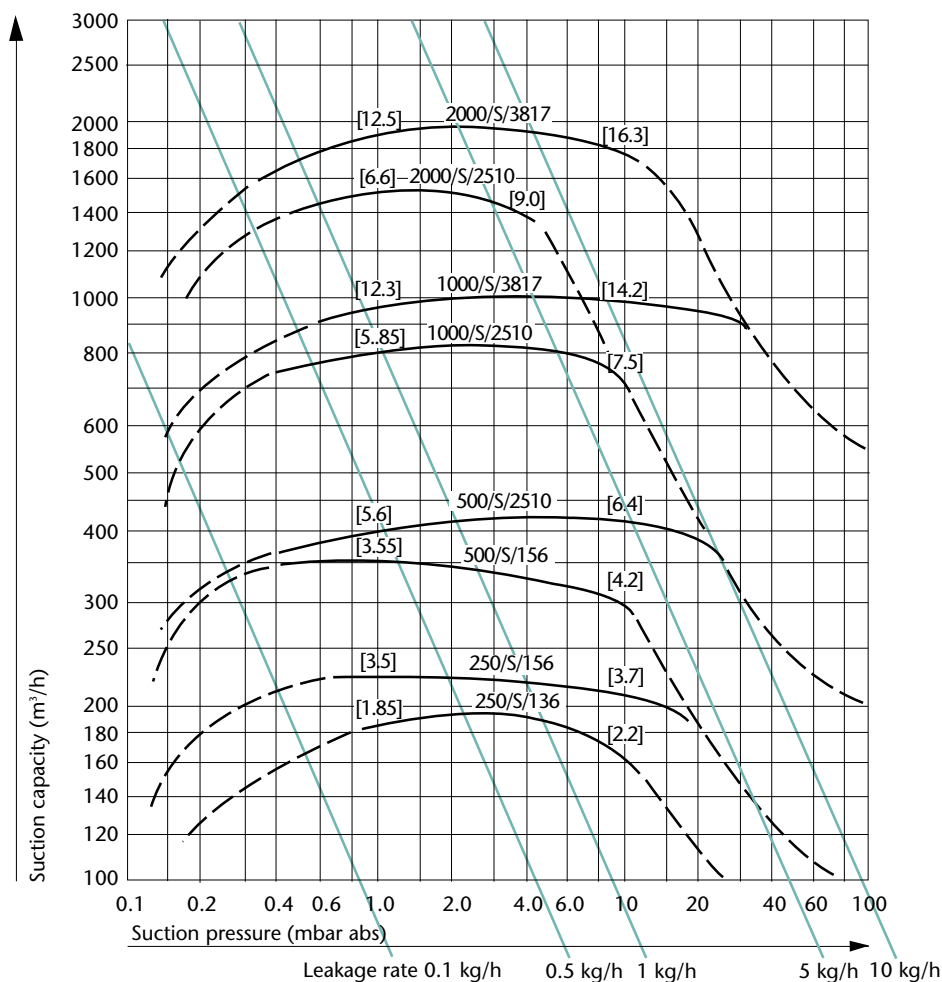
Further executions:

For other pressure ranges and higher suction capacities upon request.

Performance curves show suction capacity at given suction pressure with tolerance of 10% at following conditions:

- Evacuating dry air at 20 °C
- Compression to 1013 mbar
- Ring liquid: Water 15 °C at inlet
- [] Power absorbed in kW
- Motors 50 Hz

These lines of constant air leakage-rate p·v=const. allow the rough estimation of the COMBIVAC size required.



Technical Data

Type	Max. suction capacity	Attainable suction pressure	Working pressure range	Ring liquid in circulation at working pressure range	Cooling medium flow on APOVAC $\Delta t = 3\text{ °C}$	Max. power absorbed	Installed power protection class E Exell T3	
							pump/blower	
	m ³ /h	mbar abs	mbar abs	m ³ /h	m ³ /h	kW	kW	kW
250/S/136	190	0.25	1 bis 11	0.25	1.0	2.7	2.5	1.1
250/S/156	230	0.25	1 bis 18	0.50	1.0	4.3	4.6	1.1
500/S/156	350	0.2	1 bis 10	0.50	1.0	4.7	4.6	1.85
500/S/2510	420	0.2	1 bis 19	1.50	2.0	7.7	10.0	1.85
1000/S/2510	810	0.15	1 bis 8	1.50	2.0	8.3	10.0	3.3
1000/S/3817	1000	0.15	1 bis 24	3.40	7.0	18.0	20.0	3.3
2000/S/2510	1500	0.15	1 bis 4	1.50	2.0	9.8	10.0	6.5
2000/S/3817	1900	0.15	1 bis 11	3.40	7.0	19.5	20.0	6.5

Liquid-ring vacuum pumps as well as APOVAC dimensions acc. to separate leaflets.

Available with Conformity Declaration acc. to PED (Module H) and with ATEX certificate

Features & Advantages

General

COMBIVAC vacuum systems are multi-stage systems consisting of a roots-blower, a gas ejector and a liquid-ring vacuum pump. Each component is optimally designed for a perfect fit in the system. The COMBIVAC vacuum systems allow a totally oil-free processing of gases and vapours in the range of fine and rough vacuum with low energy requirements.

COMBIVAC vacuum systems are utilised primarily in the production of fine chemicals and pharmaceuticals with wet processes like drying, distillation, evaporation and reaction under vacuum. In cases where the suction gas contains substantial amounts of condensable vapours the installation of a precondenser is recommended. Depending on the process conditions, COMBIVAC systems can be operated with a once-through ring-liquid supply or with a closed ring-liquid loop.

The integration of a closed ring-liquid loop like the APOVAC type allows the use of condensates coming from the process. The condensates, which are recovered from the suction gas without external contamination can be fed back into the process without generating any contaminated waste water stream. All gases and vapours can be processed provided their physical and chemical properties are compatible with the construction materials.

System Concept

Basic COMBIVAC vacuum systems are composed of:

Stage 1 – Roots blower

Stage 2 – Gas ejector

Stage 3 – Liquid-ring vacuum pump

Ring-liquid cooler and tank

The individual components are mounted on a common base frame and are internally piped so that the system is ready for installation.

Standard Types' Dimensions

	Type 250/S/136	Type 250/S/156	Type 500/S/156	Type 500/S/2510	Type 1000/S/2510	Type 1000/S/3817	Type 2000/S/2510	Type 2000/S/3817
Connections								
Blower connection* according to DIN 2633	DN 65	DN 65	DN 100	DN 100	DN 150	DN 150	DN 150	DN 150
other connections see APOVAC brochure								
Approximate dimensions:								
Length (mm)	1450	1450	1450	1500	1500	1900	1500	1900
Width (mm)	850	850	850	1400	1500	2100	1600	2200
Height (mm)	1650	1650	1650	1800	2000	2000	2200	2200
Approximate Weights (kg)								
	430	470	520	760	850	1500	1150	1800
* other suction nozzle dimensions, on request								

Construction Materials

- Stainless steel DIN 1.4435 (SS 316 L)
- Other materials on request e.g. hastelloy, with lining or FDA-approved materials

Subject to dimensional and design alterations

Advantages

The COMBIVAC vacuum system has the same advantages as the APOVAC vacuum system namely:

- minimum loss of ring-liquid/ solvent and at the same time environmental friendly
- the closed ring-liquid loop allows the use of condensate from the process
- due to the practically cold compression of gases, the system is in full compliance with ATEX regulations for the handling of solvent vapours
- this system with optimally designed components guarantees a reliable availability of vacuum for many years.



Standard Combivac-System Type 1000/S/2510

A large Combivac-System for a petrochemical plant



COMBIVAC®

the vacuum system that always pays off, can be adapted individually to any special application

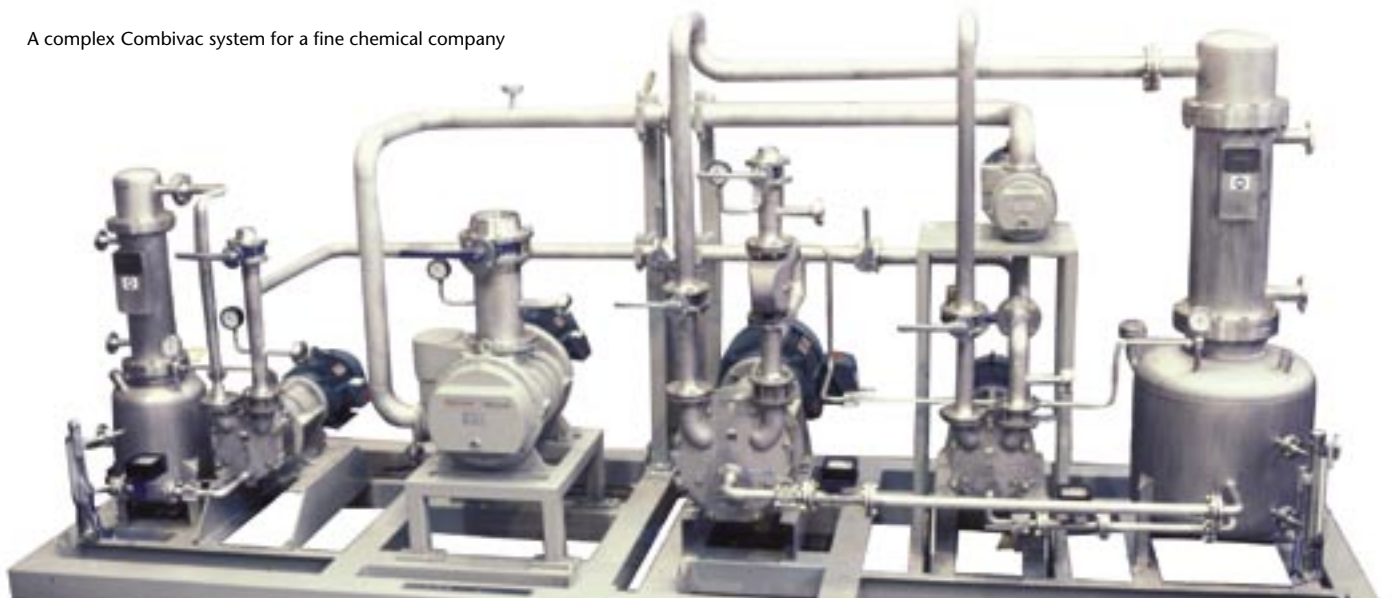
Combivac system with insulation



Combivac system with 2 liquid-ring vacuum pumps



A complex Combivac system for a fine chemical company



Principal Applications

- Process support and solvent recovery in wet processes
- Emission control, minimizing exhaust gas treatment
- Handling of toxic or corrosive gases

Major Processes

- Drying under vacuum or pressure
- Filtration
- Distillation
- Reaction
- Crystallization
- Concentration
- Degassing

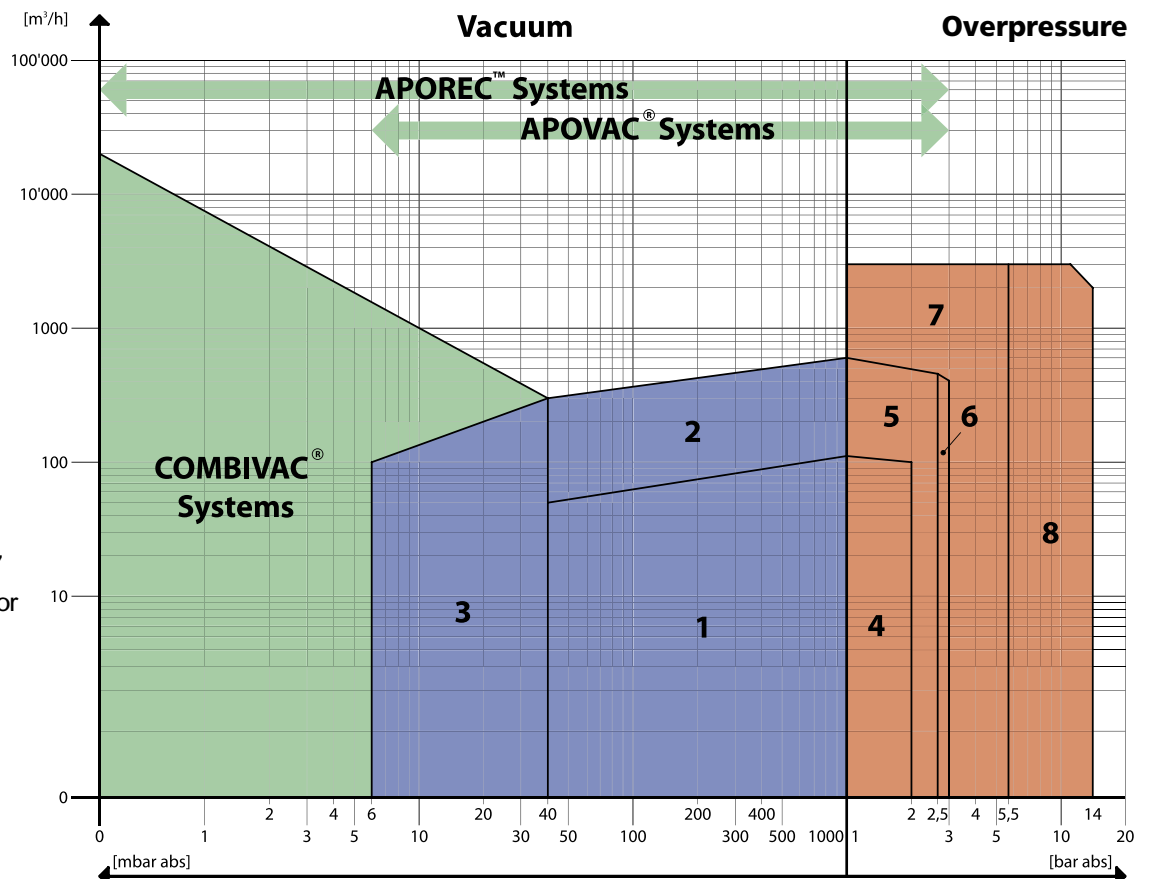
Typical Products and Industries

- Chemicals
- Pharmaceuticals
- Food industries
- Agrochemicals
- Petrochemicals
- Metallurgy

We also supply:

- Liquid-ring vacuum pumps
- Liquid-ring compressors
- Gas ejectors
- APOVAC units
- Application-related instrumentation and control equipment
- Engineering and service

Product Overview



- 1 PMH 122-156
- 2 PMZE/F 2507-3817
- 3 Pumps with gas ejector
- 4 PMK 122-156
- 5 PMZK 2507-3817
- 6 PMZE 2510-3817
- 7 SB 1-Compressor
- 8 SB 2-Compressor

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