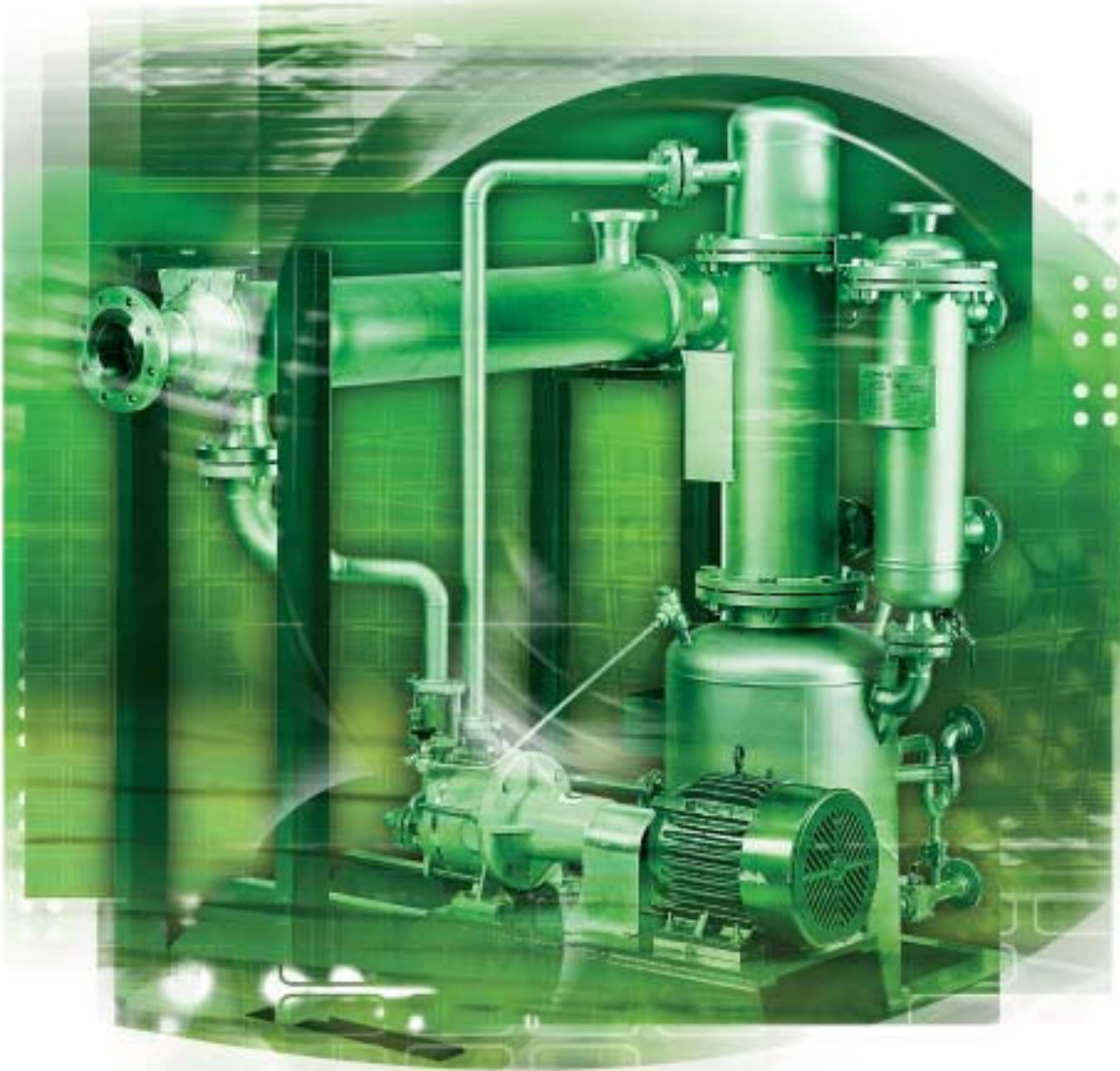


A S O L U T I O N A H E A D



gas & liquid handling
A P O V A C , C O M B I V A C , C O M P O V A C

De Dietrich
PROCESS SYSTEMS 

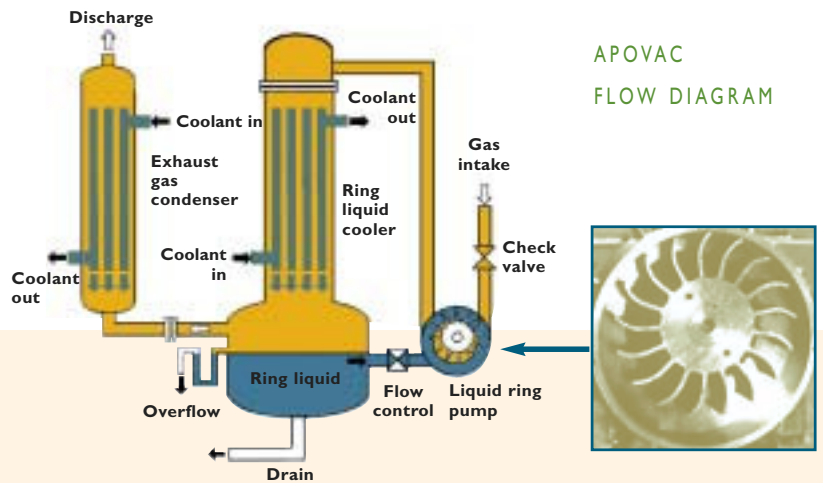


vacuum generation and solvent recovery

APOVAC ANTIPOLLUTION
VACUUM SYSTEMS SET
THE STANDARD FOR
THE EVACUATION OF
GASES AND VAPORS
WITH RECOVERY OF
NONCONTAMINATED
AND REUSABLE
CONDENSATE.



The Apovac® system is a pre-engineered unit that combines vacuum generation and solvent recovery through condensation in a closed circuit system. This advanced system uses a liquid ring vacuum pump and subsequent cooler. Ideally suited for vacuum filtration and drying, the Apovac technique offers superior performance in a wide variety of wet chemical processes including vacuum distillation, evaporation, crystallization, mixing and reactions where both single and multiple solvents are used. Apovac's skid-mounted package is easy to install and offers low maintenance and cost-effective operation. Apovac's superior technology allows for the recovery and reuse of clean solvent with minimum air emissions and zero waste water. The Apovac system eliminates oil contamination, high condensate discharge and other environmental inefficiencies and is in full compliance with VOC regulations.



APOVAC
FLOW DIAGRAM

THE LIQUID-RING PUMP, SHOWN IN THE DIAGRAM ABOVE, IS CENTRAL TO THE APOVAC SYSTEM. IT GENERATES SUPERIOR LEVELS OF VACUUM AND PRESSURE. THE PROCESS ADAPTED TEMPERATURE CONTROL FEATURE CREATES A MORE RELIABLE PUMP OPERATION AND MAKES SOLVENT RECOVERY SIGNIFICANTLY MORE EFFICIENT.

Highly Efficient Single-Stage Liquid Ring Vacuum Pump. This pump is also designed to operate as a compressor at maximum efficiency - up to 3 bar absolute.

Falling Film Cooler. Designed for maximum contact and cooling, the Apovac cooler results in high solvent recovery rates and exceptionally low exhaust gas solvent loads.

Contamination-Free Operation. The Apovac system uses the process solvent as the operating liquid which eliminates water-solvent or oil-solvent mixtures. For neutralization operations, the ring liquid can be caustic soda or a similar liquid.

Compliance With VOC Rules. With the optional exhaust gas cooler, exiting gases can be exhausted to the atmosphere in compliance with VOC rules. Standard and custom designed exhaust coolers are available.

Coolant Selection Flexibility. The coolers can be operated with separate coolants at different temperatures, creating maximum flexibility. The coolant and operating liquid never come in contact, eliminating coolant contamination.

Rugged and Reliable. The Apovac system is easy to maintain and operate. Because of its compact design, installation is simple.

Maximum Performance and Flexibility. Designed to handle many applications in one unit, the Apovac ring liquid cooler handles many solvents, always free of contamination.

Easy Operation. The Apovac can handle substantial amounts of particles, solids and liquids in the incoming vapor stream without fouling. No waste water or waste oil is produced and no additional controls are necessary. The system operates quietly and without operator intervention.

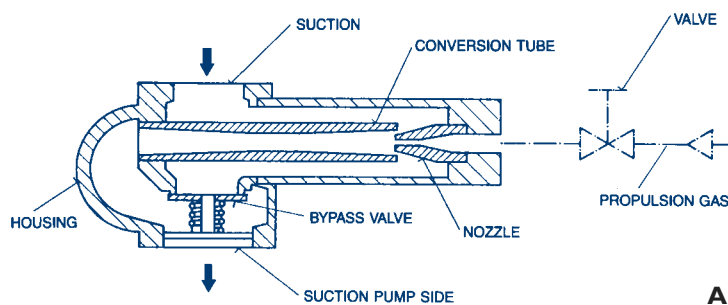
The Apovac System Saves Money. By eliminating effluent treatment, solvent treatment, and coolant treatment; and minimizing exhaust gas treatment, energy consumption, and shorter process cycles, the Apovac system can help you achieve significant savings. Even greater cost efficiencies are possible when the Apovac system is used as a gas recirculating vacuum/compressor system. Together, these operational benefits ensure a quick return on your investment.



can be adapted to any special application

APOVAC WITH INTEGRATED GAS EJECTOR (FIGURE A)

For vacuum to 5 mm Hg absolute, the Apovac system can be enhanced with a fully integrated and self regulating gas ejector. The Apovac gas ejector uses system gas vapor as its propulsion force, eliminating the need for fresh nitrogen in the ejection operation. An internal spring, responsive to decreasing suction pressure, forces the gas flow through the venturi tube. This system reduces organic emissions and gas consumption to levels well below those achieved by conventional air or steam ejector systems.

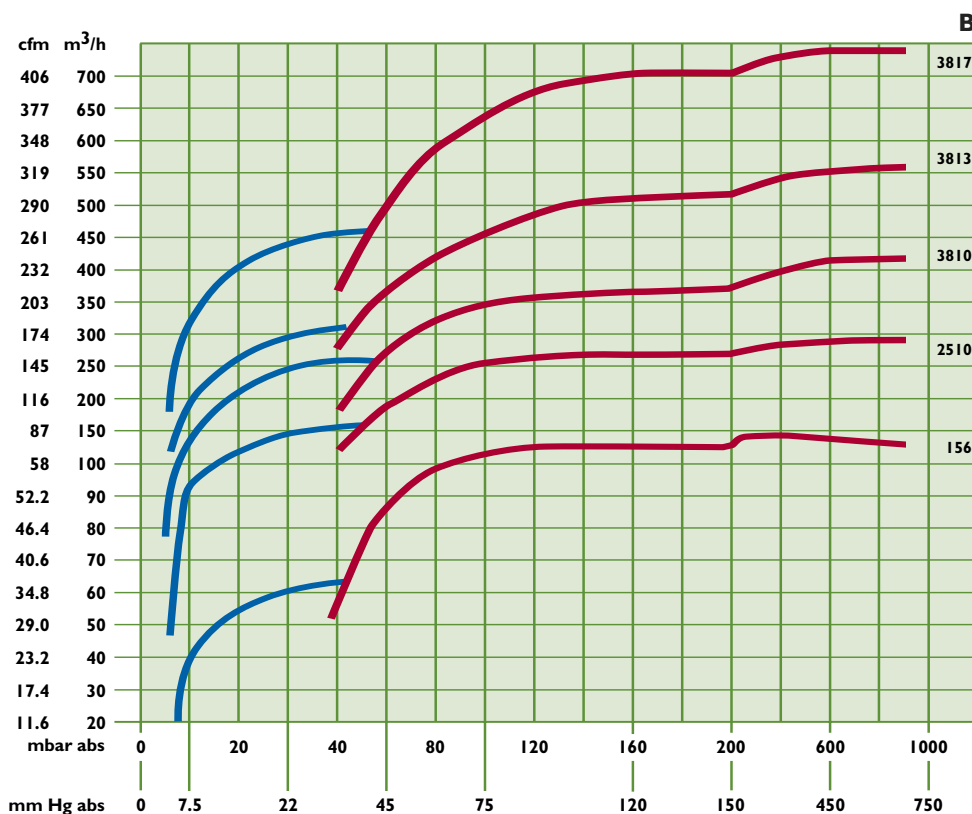


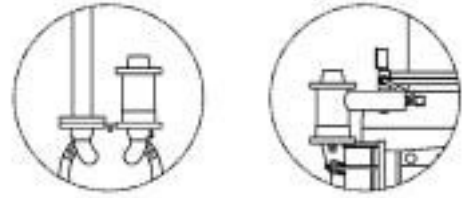
PERFORMANCE/SIZING CURVES (FIGURE B)

Performance curves show actual suction volume at a given absolute pressure with a tolerance of 10% at the following conditions:

- Evacuation of dry air at 20°C/68°F
- Compression to atmosphere
- Ring liquid: water 15°C/60°F at inlet
- 60 Hz motor service

For compression applications up to 3000 mbar abs, please contact De Dietrich Process Systems.





COMMON RING LIQUIDS

ALCOHOLS

Methyl alcohol* CH_4O
 Ethyl alcohol $\text{C}_2\text{H}_6\text{O}$
 Propyl alcohol $\text{C}_3\text{H}_8\text{O}$
 Butyl alcohol $\text{C}_4\text{H}_{10}\text{O}$
 Octyl alcohol $\text{C}_8\text{H}_{18}\text{O}$
 i-butyl alcohol $\text{C}_4\text{H}_{10}\text{O}$
 Ethylene glycol $\text{C}_2\text{H}_6\text{O}_2$
 Glycerol $\text{C}_3\text{H}_8\text{O}_3$
 Cyclohexanol $\text{C}_6\text{H}_{12}\text{O}$
 Benzyl alcohol $\text{C}_7\text{H}_8\text{O}$

KETONES

Acetone $\text{C}_3\text{H}_6\text{O}$
 Methyl ethyl ketone $\text{C}_4\text{H}_8\text{O}$

ORGANIC SULFUR COMPOUNDS

Methyl mercaptan CH_4S
 Ethyl mercaptan $\text{C}_2\text{H}_6\text{S}$

INORGANIC COMPOUNDS

Water H_2O
 Sodium hydroxide NaOH

AROMATIC

HYDROCARBONS

Benzene* C_6H_6
 Toluene* C_7H_8
 Ethylbenzene* C_8H_{10}
 Styrene (vinylbenzene)* C_8H_8
 Xylene* C_8H_{10}

HALOGENATED HYDROCARBONS

Methylene chloride* CH_2Cl_2
 Chloroform CHCl_3
 1,1-dichloroethane* $\text{C}_2\text{H}_4\text{Cl}_2$
 Trichloroethylene C_2HCl_3
 Chlorobenzene* $\text{C}_6\text{H}_5\text{Cl}$

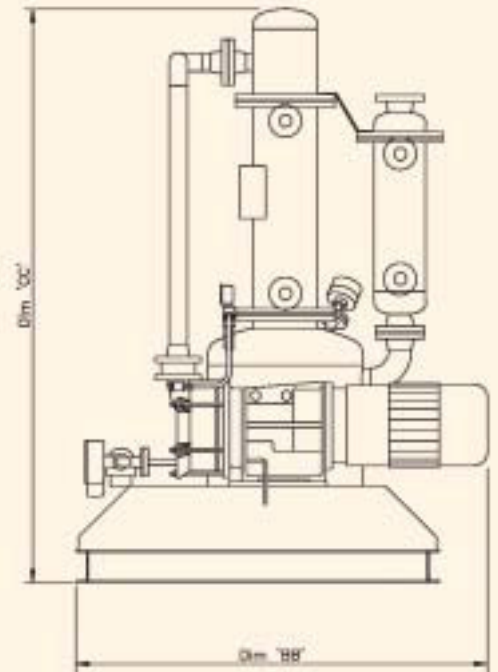
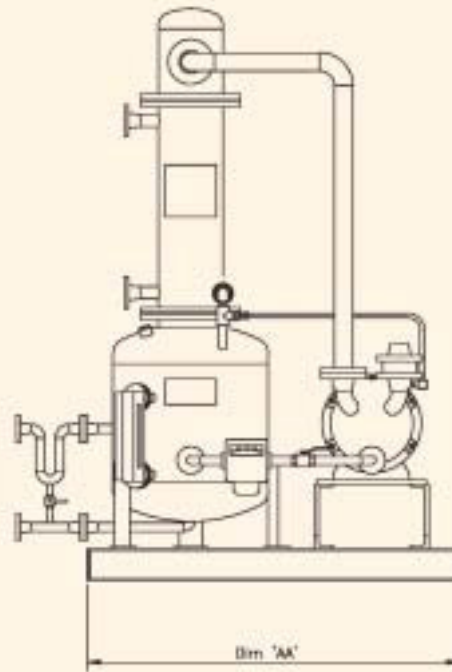
ETHERS

Dimethyl ether $\text{C}_2\text{H}_6\text{O}$
 Diethyl ether $\text{C}_4\text{H}_{10}\text{O}$
 Furan $\text{C}_4\text{H}_4\text{O}$

OTHERS

High-temperature oils
 Polyethylene glycol
 Acrylonitrile*
 Aniline*
 Diethanolamine*
 Perchloroethylene*
 Phenol*

* Clean Air Act Title III Regulated Solvents



Apovac Size

Apovac Size	Dim 'AA'	Dim 'BB'	Dim 'CC'
156	42"	47"	73"
2510	50"	60"	90"
3810	58"	70"	98"
3813	58"	76"	98"
3817	58"	79"	98"

Operational And Connection Data

MODEL	156	2510	3810	3813	3817
Maximum suction volume without gas ejector (acfm)	80	170	240	335	425
Ring liquid circulation (gpm)	2.2	4.8	11	12	14
Nominal Coolant flow (gpm)	4.4	8.8	22	31	31
Standard motors class I, division I groups C&D (HP)	7.5	15	20	30	40
Nominal speed (RPM)	3600	1800	1200	1200	1200
Approximate weight with pump & motor (lbs)	1100	2000	3200	3400	3500
Vapor Inlet Nozzle (inches)	1.5	2.5	3	3	3
Coolant In/Out (inches)	1	1.5	2	2	2
Gas Outlet Nozzle (inches)	1.5	3	4	4	4

Connections for filling, level measurement, drain, and overflow: 1"

Material of construction: 316L stainless steel; other special materials on request
 ASME code stamp

Design temperature -20 to 248°F

Design pressure 60 PSIG/Full Vacuum (process)
 90 PSIG/Full Vacuum (coolant)



system applications

FLEXIBLE AND HIGH
PERFORMING APOVAC
TECHNOLOGY PROVIDES
MAXIMUM EFFICIENCY
IN A WIDE VARIETY
OF VACUUM SOLVENT
RECOVERY AND CONTROL
APPLICATIONS.



Combivac® Systems The Combivac Multi Stage Vacuum System Blower and Integrated Gas Ejector is designed for vacuum to 1mm Hg absolute and better. The Combivac System is a highly efficient serial arrangement of Roots blowers, gas ejector and liquid-ring vacuum pumps. The Combivac System assures completely oil-free compression and evacuates gases and vapors at the lowest possible suction pressure. Standard Combivac units feature closed ring liquid circuits for process vapor condensation. This environment friendly system effectively recovers solvent and eliminates cooling media contamination.

Additional information about standard Combivac models is available by contacting De Dietrich Process Systems. (Photo A)

Compovac® Systems The Compovac Gas Recirculation System is designed to handle the gas requirements of filtration and drying in a Nutsche Filter/Dryer. The systems can be configured to perform convection drying, vacuum drying with solvent recovery and exhaust gas emission control. During drying in the blow through phase of filtration, the system recirculates compressed dry gas back into the filter resulting in minimum nitrogen consumption. (Photo B)





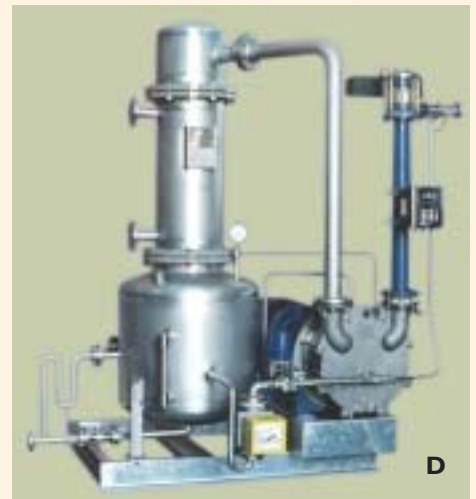
WHATEVER YOUR SOLVENT RECOVERY NEEDS, DE DIETRICH PROCESS SYSTEMS IS READY WITH THE SOLUTION YOU NEED.

Drying, Distillation, Evaporation and Reaction The Apovac system is uniquely suited for these applications where single or multiple solvents are used. Typical solvents include methylene chloride, isopropanol, acetone, hexane, toluene and propylene glycol (Photo C). Others are shown in the Common Ring Liquids table.

Neutralization Using a pH adjusted caustic soda or similar liquid as the ring liquid neutralizes corrosive and toxic vapors in the Apovac system. A static mixer added upstream of the liquid ring pump allows for high scrubbing efficiency (Photo D).

Custom Design De Dietrich Process Systems Engineering can custom design the Apovac system to address the unique requirements of your application. Customization can include pre-condensers, demisters, special exhaust condensers, dual-pump systems, PLC control and full instrumentation (Photo E).

Replacement of Existing Vacuum Systems Replacing an inefficient steam jet system with an Apovac system can eliminate high water usage and environmental problems. Apovac systems eliminate the oil contamination and high maintenance often associated with conventional rotary vane vacuum pumps.



(Photo C) Apovac vacuum system as an integrated component of a distillation, rectification and drying system in a pharmaceutical plant.

(Photo D) Apovac system with integrated static mixer.

(Photo E) Custom compressor system.

UNITED STATES
908 686 4900
704 587 0440

FRANCE
33 3 88 53 23 00

SWITZERLAND
41 61 925 11 11

GERMANY
49 61 31 97 04 0

GREAT BRITAIN
44 1785 609 900

IRELAND
353 61 366925

SOUTH AFRICA
27 11 918 4131

BELGIUM
32 16 40 5000

NETHERLANDS
31 765 42 15 44

SPAIN
34 93 29 20 520

SINGAPORE
65 861 1232

CHINA
86 21 5351 1817

BRAZIL
55 11 6703 7380



LOCATIONS

244 SHEFFIELD STREET
MOUNTAINSIDE NJ 07092
FAX 908-889-4960

908-317-2585
WWW.DDPSINC.COM
EMAIL SALES@DDPSINC.COM

9110 FORSYTH PARK DRIVE
CHARLOTTE NC 28273
FAX 908-889 4960

Copyright © De Dietrich Process Systems, Inc. All rights reserved.



The information contained in this brochure is believed to be reliable general guidelines for consideration of the products and services described herein. The information is general in nature and should not be considered applicable to any specific process or application. De Dietrich Process Systems, Inc. expressly disclaims any warranty, expressed or implied of fitness for any specific purpose in connection with the information contained herein.