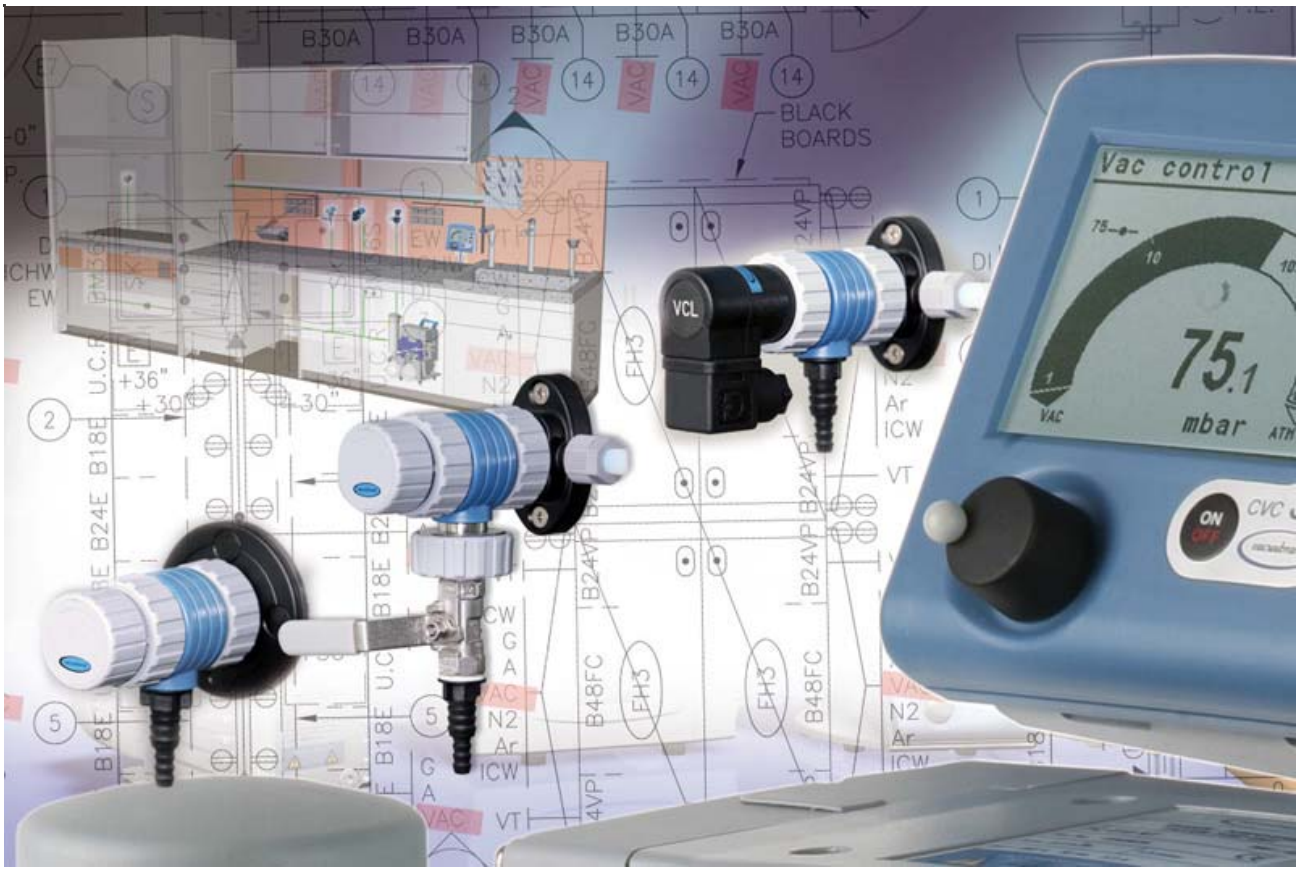


Since 50 years VACUUBRAND has been attracting a great deal of attention with continuous innovations in chemical resistant vacuum pumps and unique control technologies for use in chemistry laboratories.
With the VACUU·LAN® system VACUUBRAND was the first manufacturer to introduce a fully modular concept which is suitable for vacuum installations in new laboratory buildings as well as refitting for remodelling or refurbishment of existing labs. The current operating modules are of the third product generation.

The idea of VACUU·LAN® is to supply a locally limited lab area with just one vacuum pump, applicable to several work stations in simultaneous operation and with different applications. Major benefits of a VACUU·LAN® system are the greatly improved availability, compared to conventional reticulated central vacuum systems and out-dated waterjet pumps, as well as enhanced control options and better vacuum performance. Furthermore VACUU·LAN® stands for user-friendliness and ease of installation and maintenance.

VACUU·LAN® Vacuum Local Area Networks

The state-of-the-art alternative for central vacuum systems

What is VACUU·LAN® - comparing to conventional systems

Often there are several workplaces in laboratories where vacuum is used. The vacuum needed at each vacuum port may differ widely, along with the importance of vacuum and flow rate control. Vacuum pumps themselves also exhibit great range in pumping speed, ultimate vacuum and capability to control vacuum conditions. Simple vacuum is needed for filtration or aspiration of liquids. Gel drying benefits from flow control. Rotary evaporators and other distillations, on the other hand, are easier to manage, more cost-effective, and provide environmental benefits with electronically controlled vacuum with optional flow control.
The choice among the three common alternatives for scientific vacuum supply**—reticulated central systems, individual vacuum pumps for each user, or local vacuum networks—**involve many considerations of both cost and performance.

Reticulated central vacuum systems
Reticulated central ("house") vacuum systems are still common in existing laboratories and laboratory buildings, but in daily use they can be problematic:

- **Unsatisfactory performance**

  The available pumping speed and ultimate vacuum are often not sufficient, especially when other users are introducing larger amounts of gases to the system. To address this risk, central systems are typically oversized, causing excess installation costs and long-term operating costs. Cross contamination and interference cannot be avoided because of unintended backflow of pumped gases. Condensates may form in the tubing and thus limit the achievable ultimate vacuum.


Reticulated central vacuum system with pump and buffer tank

- **All or nothing operation, with high energy and service costs**

  If for whatever reason the system is down, nobody can work, so a high availability must be ensured.
  To accomplish this reliability, a backup pump has to be installed. The two pumps alternately run 24 hours a day, 7 days a week, even if the building is unoccupied, or there is no demand for vacuum. Unnecessarily high service and energy costs are the result.

- **Environmental and safety concerns**

  Central vacuum systems are convenient for laboratory staff since they have no responsibility for the system's maintenance and because the investment often is done from the general construction budget. But users do not feel responsible for a system they cannot see. Gases, vapors and liquids carelessly sucked into the central system form an unpredictable toxic and potentially explosive mixture that is usually corrosive to system tubing. Controlled collection of isolated vapors is not possible. Uncontrolled release of harmful substances cannot be prevented. In biotech applications, the use of a reticulated system can noticeably increase the risk of uncontrolled release of bacteria and infectious substances.

- **Over-specification**

  The central vacuum pumps have to be specified for the maximum demand. Projecting that demand needs to anticipate the maximum number of users, and the peak demand by those with access to the system. This typically involves specification of pump size, and tubing runs, valves and fittings,

that are well beyond the expected or average use, leading to excess installation and lifetime costs.

- **Limited vacuum capability, and risks to experiment security**

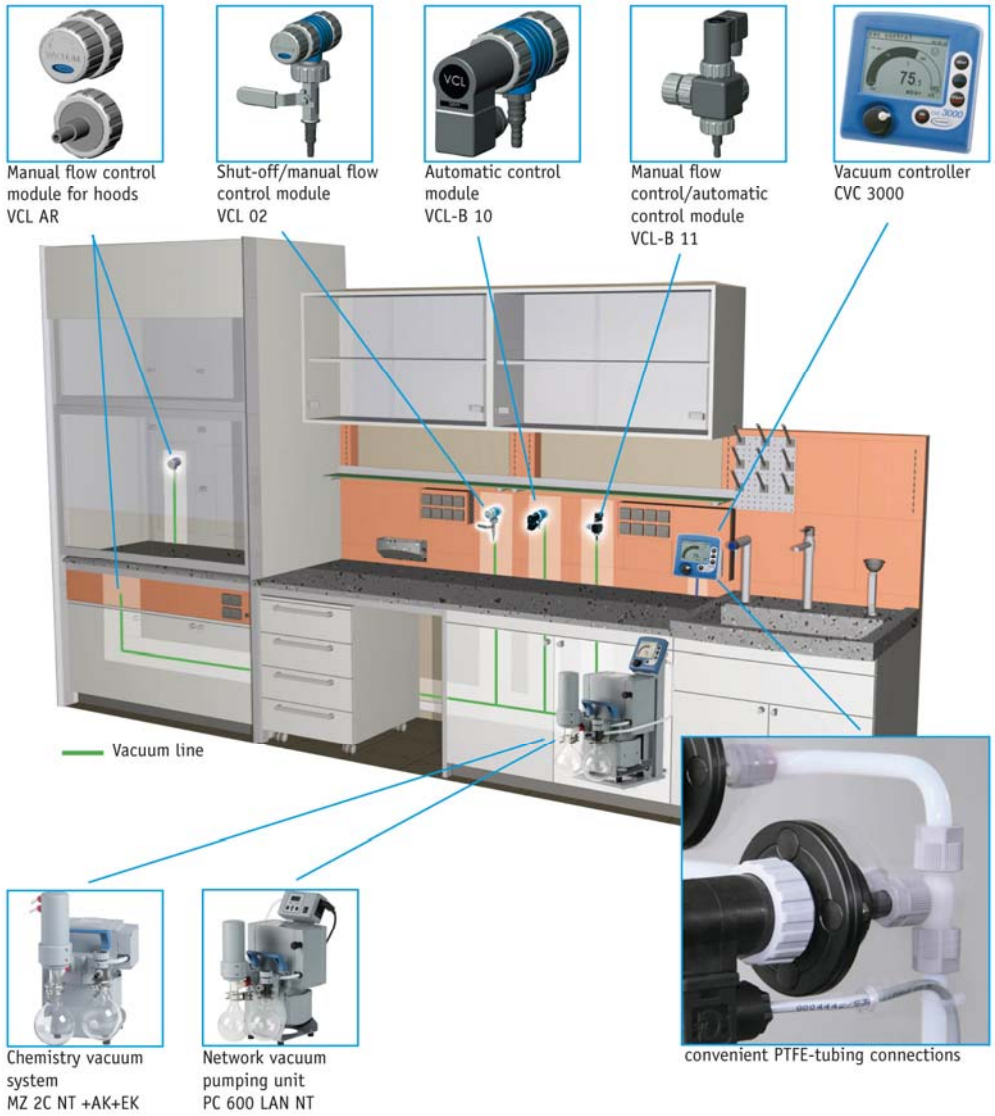
  Applications that need specialized vacuum usually need dedicated pumps. Examples include most distillations or evaporations requiring tight control; drying processes needing deeper vacuum; operations needing biological containment; or extremely sensitive instruments such as mass spectrometers which must not be contaminated or need specialized vacuum beyond the capacity of system pumps. In these cases, provision of central vacuum merely duplicates vacuum investment at a workstation that will require a dedicated pump.

Local vacuum supply based on individual pumps

A local vacuum supply based on individual pumps for every application allows for tailored solutions with optimum performance for every user. Organizationally, it involves a wide variety of dedicated pumps, occupies a lot of lab space, and often has the highest investment costs, even though it offers low long-term operating costs, since each pump is used only when needed.

VACUU·LAN® - local area vacuum network

A VACUU·LAN® local area vacuum network is an advantageous compromise between dedicated pumps and a reticulated central vacuum system. It offers lab bench-space savings, high performance and easily adaptable vacuum supply with a moderate capital investment.



The local area vacuum network offers many of the advantages of both basic ideas. The vacuum supply by a single corrosion-resistant diaphragm pumping unit to several vacuum ports on one lab bench, a row of fume hoods, or a complete laboratory, is a cost- and space-saving alternative to individual pumps for every application. At the same time, VACUU·LAN® networks preserve many of the advantages of dedicated pumps versus a central system, and offer the following advantages:

- **Local vacuum supply**

  Local supply means one chemical resistant, oil-free pump operates almost noiselessly in the lab, providing vacuum to as many as 10 workstations as a row of fume hoods, a lab bench, or even for an entire small laboratory.

- **Precisely adapted specifications**

  Avoid overbuilding or under-capacity by providing vacuum in accordance with real user demand.

- **Active environmental protection and safer operation**

  Dry running chemistry diaphragm pumps do not consume resources like oil or water. Users of local vacuum networks within a laboratory will know the substances with which they are working, and can consider the risks of interactions. Hence, the risk of forming explosive or harmful mixtures is reduced. Chemistry diaphragm pumps permit corrosive vapours to flow through the pump, allowing solvent recovery at pump's exhaust, and proper recycling or disposal. Uncontrolled emission of solvents is minimized.

- **High performance**

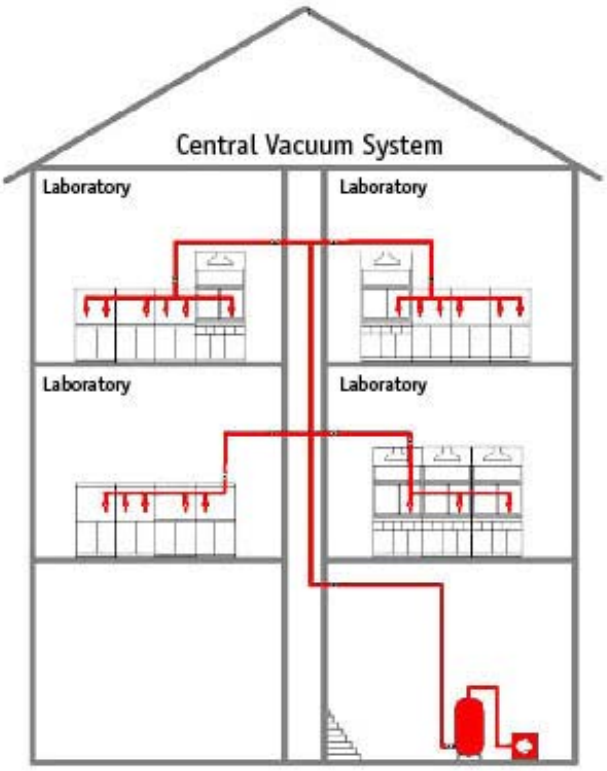
  Pumping speed and ultimate vacuum of the vacuum pump can be chosen with regard to the actual demands of the local users. Cross contamination and interference among applications are minimized by highly efficient non-return-valves (check valves) that are integrated into the vacuum ports.

- **Reduced maintenance, energy and service costs**

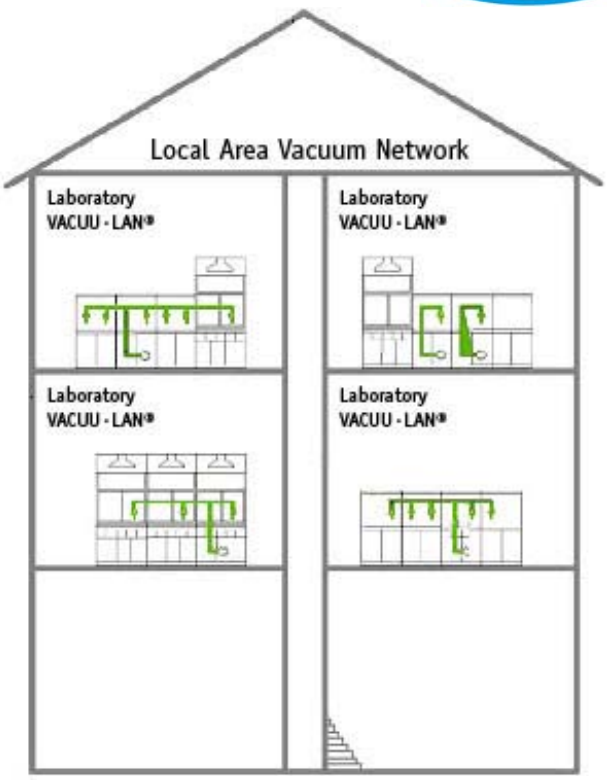
  Service intervals can be scheduled by directly considering the actual running time of the system. The tubing as well as the vacuum ports is made from fluoropolymers and other materials with excellent chemical resistance. They can easily be disassembled and cleaned or disinfected by the laboratory staff without the use of special tools. And the system is operated only as needed, reducing energy consumption and extending service intervals.

- **Modularity and flexibility of the system**

  The system can easily be expanded and the vacuum ports can be modified as demands change.



Central Vacuum Supply – oversized and mostly uneconomically operated



Local Area Vacuum Network – optimized and convenient

Limitations of reticulated central vacuum systems for the various vacuum demands in daily laboratory operations

Multidisciplinary lab buildings, where many of the labs have no need for vacuum, or cannot use the vacuum that can be provided by a central vacuum system. Physicists typically need vacuum that is beyond the capability of a central system. Chemists often need very stable or electronically controlled vacuum. Biological applications (filtration, aspiration) can often be served by the quality of vacuum provided by a central system, but these applications may need isolation and typically contribute the instability to the system that is so problematic to the chemists.

When **renovating a science building**, old vacuum lines are often corroded, leaky and need replacement. You can avoid the investment and disruption of replacing a building-wide vacuum utility by installing VACUU·LAN® networks only where vacuum is needed, one lab or one floor at a time. Staged renovations that proceed while the rest of the building is in use don't disrupt vacuum supply to working labs; you add the vacuum utility to each lab as it is renovated.

Multi-tenant science buildings, such as scientific business incubators, need to have fully functional labs available for the next client firm. But some of your clients will need vacuum for their instrumentation; some will not. Investing in a building-wide vacuum system "just in case" incurs the power and maintenance costs of the house vacuum irrespective of the future tenants' needs.

In clean rooms and bio-containment suites the essentially required isolation from adjacent users would be compromised by reliance on a common vacuum utility. Central vacuum supply is absolutely inappropriate since contamination of the vacuum system, and therefore hazardous effects on other laboratories, cannot be excluded.

Flexible use of laboratory facilities requires fast adjustment of vacuum lines, without any solid piping installation. When rearranging lab inventory due to changing requirements, vacuum connections should be able to adopt fast and easy.

Green building services engineering gains more and more importance in times of limited resources and booming ecological considerations. When a central vacuum system is installed to serve an entire building, the system must be sized to serve peak demand. That means the vacuum pumps must be oversized to ensure support to all possible future users, and tubing must be installed throughout the building. This is not an efficient use of resources unless it is actively and continuously used. These large pumps typically must operate 24/7/365. In addition normally a back-up system is necessary to compensate any failure down-time.

Your solution: The vacuum local area network VACUU·LAN®

As stated before, individual pumps for each user and application is the optimal configuration, but bringing high investment cost and large space requirement for the equipment.
In VACUU·LAN® networks on the other hand a single pump can supply up to 10 workstations with different applications. The server pump unit's performance is laid-out according to known requirements. Vacuum is generated on-demand. The system controller either adapts the pump's running speed, adjusting its pumping speed capacity, or directly switches the unit in on/off-operation.
The vacuum source can be fully integrated in sub-frame cabinets under workbenches or fumehoods, where operation is whisper-quiet. With an emission condenser at the outlet side of the vacuum pump lab solvent vapors can be captured locally and condensed for re-use or proper disposal, with recovery rates of close to 100%. An optional liquid level detection sensor prevents overflowing of the recovery flask and therefore maximizes operational safety.

The installation, with vacuum piping networks connecting the pumping unit to the vacuum ports, is done in shortest time without any need for special tools, using PTFE-tubing and corresponding connectors. VACUU·LAN® modules can be installed surface-mounted or fully integrated, with manual regulation or electronic control valves. Electronic control valves are solenoid operated and switched by a vacuum controller to keep preset vacuum values stable for the corresponding vacuum port. This workstation controller can be mounted in clear position close to the application, by integration into the lab furniture panel.

The procedure of planning a VACUU·LAN® vacuum local area network

For planning procedures of public or company-owned laboratory buildings in most cases a very long lead-time, sometimes up to several years, must be considered, no matter if it is referring to new building construction, remodelling, or renovation. In the planning phase general measures and budgets are to be

set, detailed layouts are prepared and tender specifications to the bidding suppliers are provided. Before the tender starts the decision between central system and local vacuum network has to be made.
When deciding for a VACUU·LAN® vacuum local area network, at first the general demand for each workstation should be defined according to the intended applications. In this way the right pump, with sufficient performance, as well as appropriate VACUU·LAN® modules can be chosen. Is electronic vacuum control required or will manual regulation be sufficient? Will coolant supply for solvent recovery be required? Surface-mounted or integrated installation? ...
Our VACUUBRAND specialists are considering the specific demand per port and give expert advice or even suggest more economic alternatives. These considerations at early stage of planning will help to save time, cost, and resources during the construction period as well as in daily operations.

Most lab furniture suppliers are already offering solutions with integrated VACUU·LAN® technology to lab designers. Nevertheless, a good communication between the lab designer, the lab furniture supplier, and VACUUBRAND's vacuum specialists is essential for optimal system layout. Several hundreds of lab buildings worldwide with up to 3000 vacuum ports per building have been equipped with this VACUUBRAND technology. VACUUBRAND's long-year experience in planning and layouting for public as well as commercial lab facilities assures to provide optimal solutions to the specific customer requirements.

Components of a VACUU·LAN® network

The essential components of a VACUU•LAN® network are the pump, or pumping unit with on-demand operation, the vacuum ports, the PTFE-tubing networks and fittings.
Network server pumps are all based on our compact, chemical-resistant, oil-free diaphragm designs. All are built for long service intervals, excellent pumping speeds even close to ultimate vacuum, and reliable restart under vacuum. All pumps are whisper-quiet in operation.

Pumping unit suggestions for VACUU·LAN®

MZ 2C NT +AK +EK Chemistry Vacuum System

This chemistry diaphragm pump has a wide range of applications, like evacuation, evaporation, and pumping of gases in chemical, biological, or pharmaceutical laboratories. The separator at the inlet (AK), made of glass with protective coating, retains particles and liquid droplets to protect pump performance. The waste vapour condenser at the outlet (EK) is highly efficient and compact. The condenser enables near-100-percent solvent vapour recovery and efficient solvent recycling, while actively protecting the lab atmosphere and external environment from exhaust emissions.

PC 500 LAN NT

This ready-to-connect chemistry vacuum pumping unit is optimized for automatic on-demand vacuum generation in local area vacuum networks, e.g. VACUU·LAN®. The pump turns on and off automatically, according to the actual vacuum demand. The on/off switch points can be set independently. This chemistry vacuum pumping unit is frequently used for medium-sized vacuum applications at multiple workstations in laboratories. The pumping unit includes a VNC 2 vacuum controller with digital vacuum display and connections for a cooling water

valve and optional liquid level sensor for the catchpot at the exhaust waste vapour condenser. VNC 2 also includes readout of the liquid level detection sensor.

PC 600 LAN NT
This ready-to-connect chemistry vacuum pumping unit is optimized for automatic on-demand vacuum generation in VACUU·LAN® local area vacuum networks. The pump turns on and off automatically in response to vacuum demand. The on/off switch points can be set independently. Based on the MD 4C NT pump, the PC 600 LAN NT meets the higher vacuum requirements of multiple workstations in laboratories. The pumping unit includes a VNC 2 vacuum controller with digital vacuum display and connections for a cooling water valve and optional liquid level sensor for the catchpot at the exhaust waste vapour condenser. VNC 2 also includes readout of the liquid level detection sensor.

VACUU·LAN® connections
VACUU·LAN® networks are installed with PTFE tubing ID 8 mm (OD 10 mm). The PTFE material assures excellent leak-tightness and chemical resistance. Elbow and T-connectors feature the same resistance level combined with excellent flow-through characteristics and easy-mounting, without any need for special tools.

VACUU·LAN® modules

All operating modules feature corrosion resistant fluoropolymer membranes and non-return valves to minimize interference and cross-contamination between different applications.

VCL 01- manual flow-control module, mountable in horizontal and vertical direction.

VCL 02- manual flow-control module with separate shut-off valve

VCL-B10- electronic control module with solenoid valve, allowing automatically controlled vacuum via electronic vacuum controller at a network port

Further module options are available upon request

Vacuum controller

CVC 3000 can be used either as network-controller, controlling VARIO® network pumping units on demand, or as workstation-controller for vacuum control through a solenoid valve. Menu-based operation with graphic display and jog wheel is virtually self-explanatory. The integrated venting valve and a highly resistant alumina ceramic vacuum sensor ensure excellent measuring reliability independent of gas type.

Conclusion

In modern chemical and pharmaceutical lab buildings vacuum supply has become a standard for each work station, just as water or gas supply. Therefore vacuum supply solutions are considered at earliest stage for new laboratory buildings and are fully integrated in the planning and layouting procedure in many cases. Demands for vacuum vary over a wide range of applications – e.g. evaporation, distillation, vacuum drying, or simply filtration and aspiration. All of these can be covered well by Chemistry Diaphragm Pumps.
VACUUBRAND offers the vacuum local area network VACUU·LAN® as state-of-the-art vacuum solution at moderate investment cost levels, but significantly reduced operating, service, and maintenance costs. Furthermore VACUU·LAN® saves valuable lab space and its modularity leaves flexible options for any upgrades and modifications due to changing requirements in the lab.

For further products and information see:

www.vacuubrand.com

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