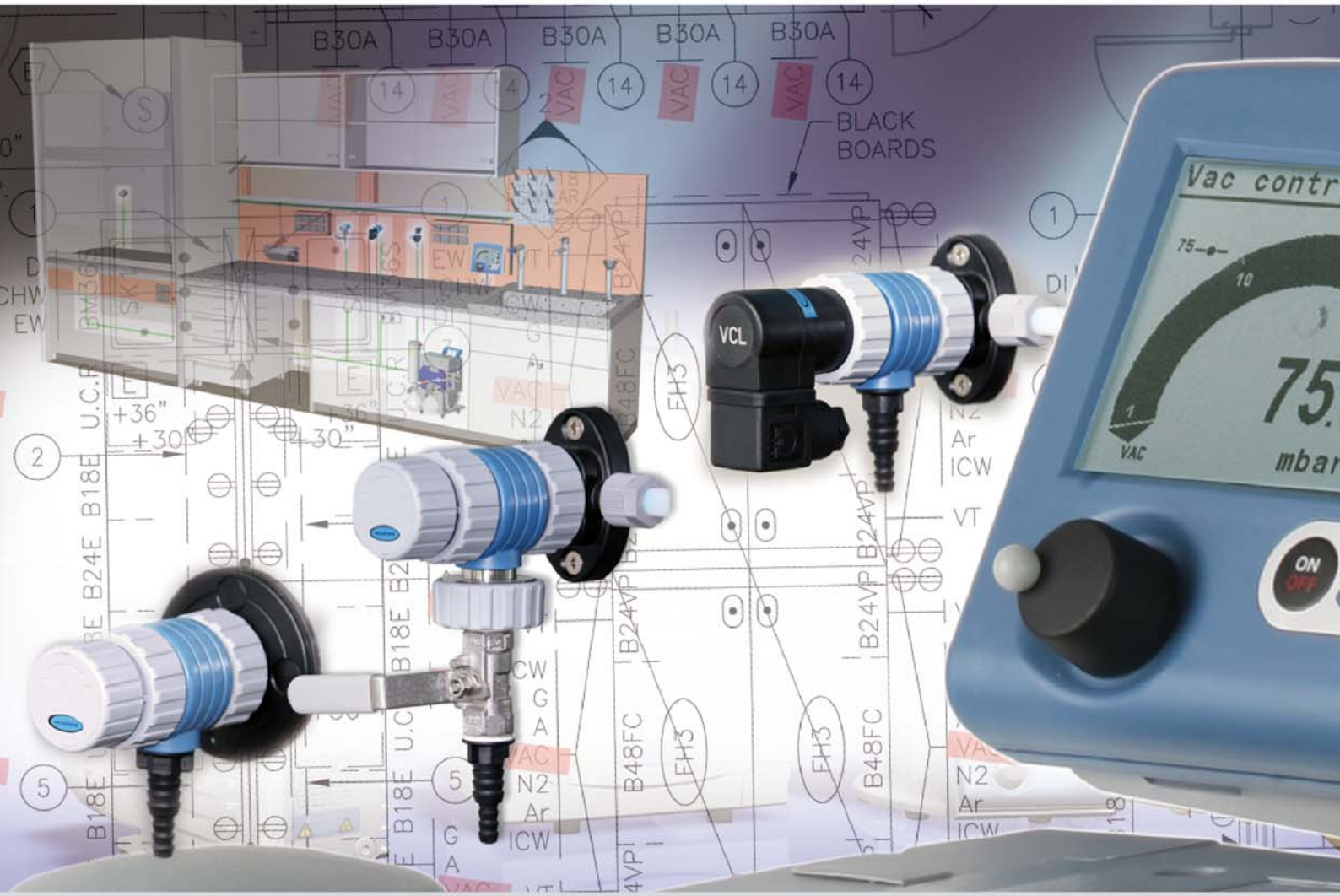

VACUU · LAN®

Vacuum Local Area Networks

Guidance for the selection of pumps and connections

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Appendix A – Making a VACUU·LAN® Tubing Connection

2 Introduction

Often there are several workplaces in laboratories where vacuum is used. The vacuum needed at each vacuum port differs 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 drying or aspiration of liquids. Filtration 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 system, individual pumps or local vacuum networks?

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, encouraging 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.

- 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 some 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 at a workstation merely duplicates vacuum investment at a workstation that will require a dedicated pump.

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.

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.

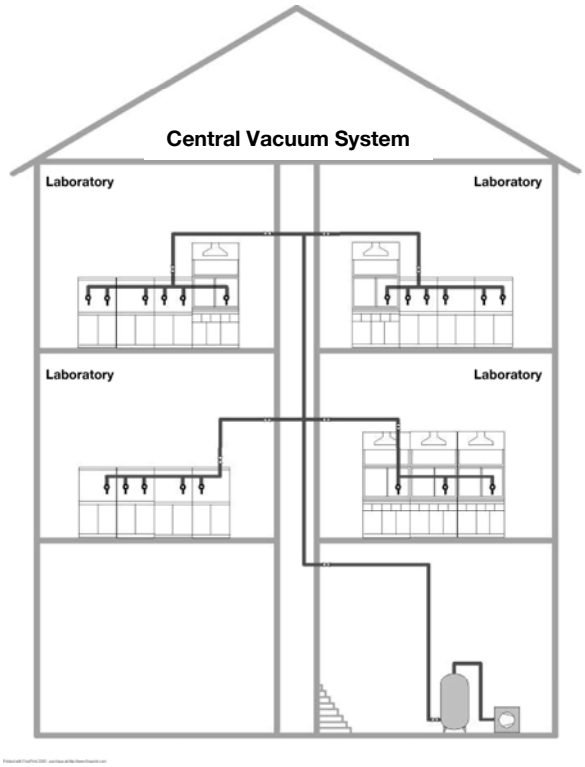
- Precisely adapted specifications
  Avoid overbuilding or under-capacity by providing vacuum in accordance with real user demand.

- 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 vapors to flow though the pump, allowing solvent recovery at pump's exhaust, and proper recycling or disposal. Uncontrolled emission of solvents is minimized.

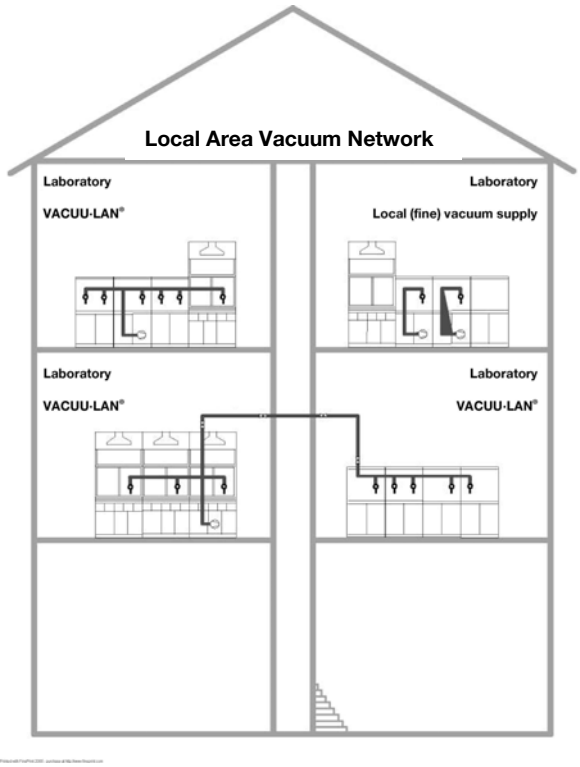
- High performance
  Pumping speed and ultimate vacuum of the vacuum pump can be chosen with regard to the actual demands of the local users. Cross contamination and interference among applications are minimized by highly efficient non-return-valves (check valves) that are integrated into the vacuum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



Local Area Vacuum Network – optimized and convenient

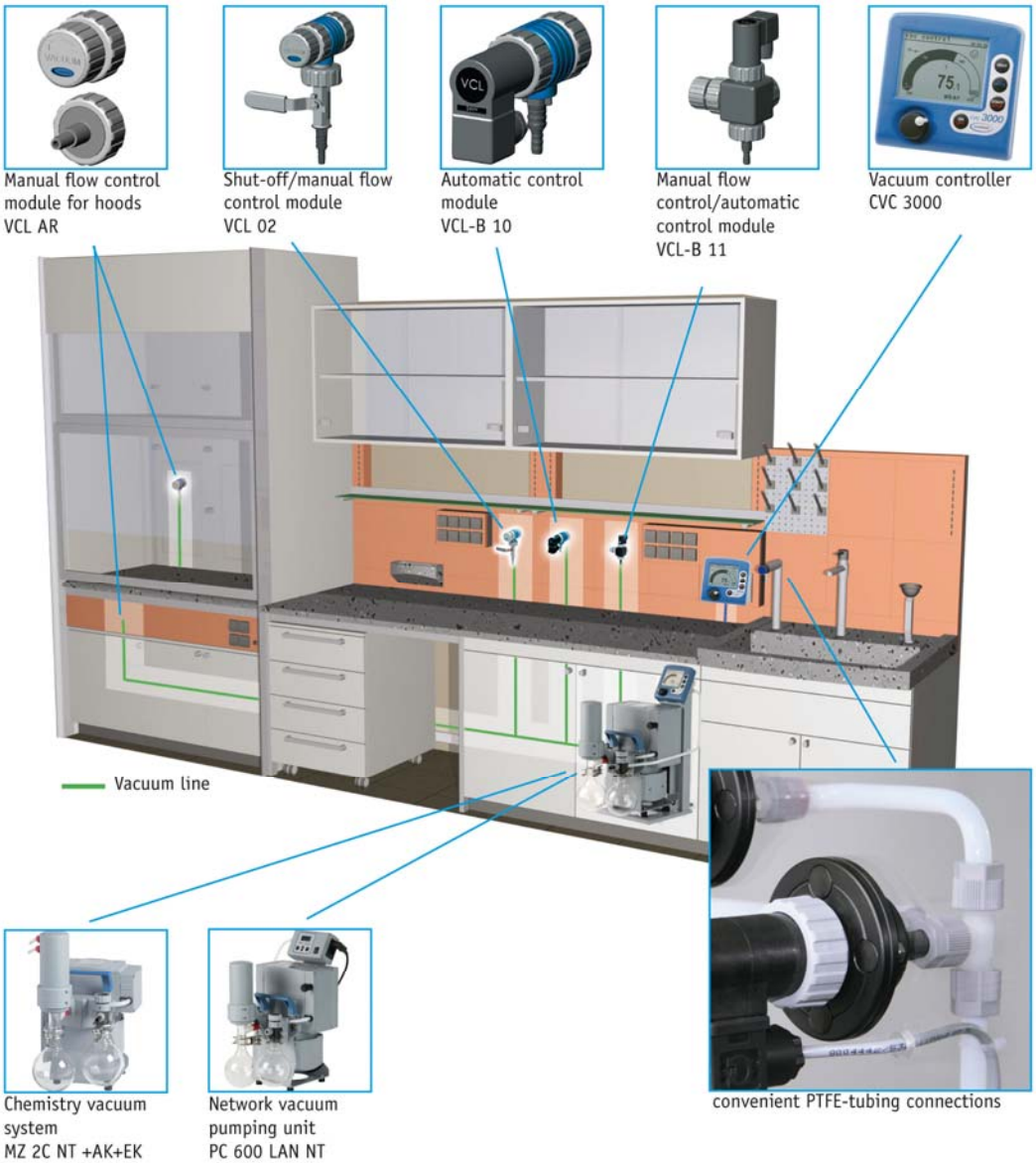
2.1 Design and Layout of VACUU·LAN® Local Area Vacuum Networks

A VACUU·LAN® network always consists of the following components

I. **chemistry diaphragm pumping unit with integrated accessories**
such as inlet catchpot, exhaust waste vapor condenser and optional pump management systems

II. **vacuum ports**
selected in accordance with the specific workstation needs

III. **tubing**
to connect the chemistry diaphragm pumping unit with the vacuum ports



Tip:
The optimum configuration for any lab, with regard to performance and economy, will determine the selection of the proper components. This handbook can guide you in the numerous factors to consider in configuring a VACUU·LAN® vacuum network, but it cannot replace experienced advice from our experts. We would be pleased to support your efforts to design the best possible solution.

2.2 Important Technical Considerations about Local Area Vacuum Networks

Insufficient vapor conductance by system components (e.g., because of too small inner diameters of tubing, fittings and valves, poor tubing surface quality or too many angles in the tubing network) can decrease achievable ultimate vacuum and lower the effective pumping speed significantly. Compared to standard tubing in building construction, the leakage rate plays a very important role in a vacuum network. Even apparently small leaks can have a large influence on the achievable ultimate vacuum.

Thus, we cannot ensure the performance of our networks if VACUUBRAND products are combined with tubing, fittings or valves from any other source. This applies also to components purchased from suppliers offering the same general specifications as our own (e.g., inner diameter or wall thickness). The surface quality and elasticity of tubing, for example, have an important role in the leak-tightness of a network. The design and quality of sealing area surfaces are also very important, and the quality can vary greatly for products from different sources.

We take great pains to ensure the quality of third-party products used in our systems, devoting considerable expertise and time to inspection and release. We do not know the product quality in case the manufacturer is not a company we continuously work with. Our experience with components from other manufacturers indicates that samples may seem satisfactory but small variations in the actual delivery can cause considerable complications in the performance of the final network.

A VACUU·LAN® local area vacuum network only fulfills users‘ requirements if:

- the system is powerful enough in terms of pumping speed and ultimate vacuum and is able to achieve these values even in the long run;
- highly efficient non-return (check) valves are integrated which work properly even in the event of small differential pressure among the various applications;
- valve malfunctions, e.g., due to the inevitable deposits from vacuum vapors, are easy to correct quickly and without the use of special tools; and,
- the vacuum ports can easily be adapted to changing demands or replaced quickly and easily, without the need for special tools.

3 Chemistry Pumping Units and Systems for Vacuum Networks

The vast majority of lab applications—filtration, rotary evaporation, drying, concentration—can be accomplished at “rough” vacuum levels, namely, those that are within the vacuum range of dry vacuum pumps. (Freeze-drying and molecular distillations are exceptions). VACUU·LAN® vacuum networks, thus, rely on oil-free VACUUBRAND® chemistry-design diaphragm vacuum pumps for the advantages of reliability, service convenience, corrosion resistance and control that these pumps offer.

VACUU·LAN® pumping units and systems include:

A 100 % oil free, chemistry diaphragm pump, with

- **high pumping speed** even at low vacuum;
- cylinder heads made of **reinforced ETFE with stability core;**
- **internal tubing and fittings made of PTFE/ETFE/ECTFE compounds;**
- **planar sandwich diaphragms** with extruded high density, high flexibility PTFE and optimized kinetics to reduce internal stresses;
- CNC-manufactured **clamping disc made of reinforced ETFE;**
- electrical overload protection;
- **CE-conformity**: machine directive, low-voltage directive, electromagnetic compatibility directive;
- reliable restarting, even under vacuum conditions;
- typical diaphragm **service life of 10,000 operating hours** or more; and,
- Patented new valve mounting system to simplify service access.

Integrated accessories:

- **inlet separator (AK) at inlet side, for the separation of droplets and particles**
  - 500 ml volume glass catchpot
  - plastic coated to protect against implosion and breakage
  - quick and efficient fitting and removal using metal joint clamp.

- **robust gas ballast mechanism for removal of condensates**
  - continuous removal e.g., of condensates from aqueous media
  - protects pump performance from re-evaporation of line condensates
  - excellent pumping speeds, even with full-time gas ballast protection.

- **outlet emission condenser (EK) at exhaust side, for solvent recovery and protection of the environment**
  - compact emission condenser with optimal conductance of the pumped vapors across the cooling surface
  - cooling surface area ~ 500 cm²
  - descending connection line between the pump and the condenser to prevent condensate drain-back
  - overpressure relief valve
  - insulation and protection against condensation
  - plastic coated catchpot for safety containment, protection against breakages and cracking
  - quick and efficient catchpot fitting and removal using metal joint clamp
  - 500 ml volume catchpot

3.1 General Notes on the Chemistry Pumping Units and Systems

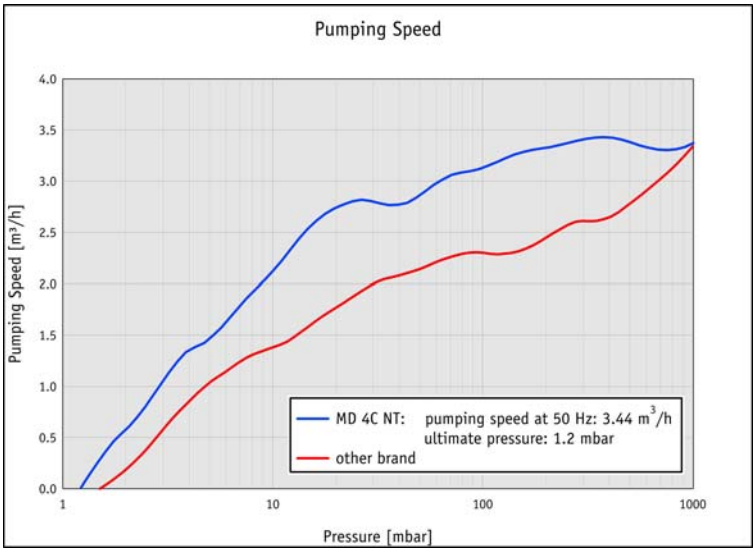
Selection Criteria

We recommend the use of an inlet separator (AK) inlet side to protect pump performance from particulates and line condensates, and an emission condenser (EK) at outlet side to recover solvent vapors for recycling or proper disposal, and to protect the lab and external environment from waste vapor. In short, we recommend an integrated pumping unit or pumping system with these features for the most reliable pump performance, reduced maintenance and environmentally responsible operation.

Criteria for selection of the pumping units are:

- **operating pressure:**
  1.5 mbar / 1.1 Torr ultimate vacuum (three stage) or
  7 mbar / 5 Torr ultimate vacuum (two stage) pumping unit.

  note:
  Besides the ultimate vacuum specification of a vacuum pump, the “pumping speed” is the other standard specification. The pumping speed of a vacuum pump refers to its speed at atmospheric pressure. The *effective* pumping speed declines over the operating range, with the “ultimate vacuum” being reached, by definition, at the point at which the pumping speed falls to zero. One important measure of the quality of a pump is the *rate* of decline of pumping speed over the pumps’ vacuum range; pumps differ substantially in this characteristic, which strongly influences the length of time it will take to complete vacuum applications at any vacuum pressure.



  Three-stage chemistry pumps have a higher pumping speed by design at lower process pressures and the final vacuum is less influenced by condensates (e.g., aqueous media). Where the intended operating vacuum is close to that of the ultimate vacuum of the two-stage (7 mbar) pump, then it is better to use a three or four stage unit, since a two-stage pump operating in the range of 10 mbar has only a small portion of its design pumping speed left.

- **pumping speed:**
  Depends upon the size of the application and the quantity of gas which must be evacuated

- **network size, number of vacuum ports:**
  The larger the **VACUU·LAN®** network and the greater the number of vacuum ports that will be in use at one time, the greater is the pumping speed requirement for the pump.

- **pump and coolant management:**
  - continuously available vacuum without continuous pumping
  - control of cooling water flow, to conserve water when pump is not in operation
  - optional monitor and alarm against overfilling of catchpot
  - system is self drying

Network pumping units: the VACUUBRAND PC 500 LAN NT and PC 600 LAN NT
The network pumping units PC 500 LAN NT and PC 600 LAN NT provide fully automatic vacuum control in VACUU·LAN®- networks. The pumping units are ready for operation out-of-the-box, with the VNC2 network controller already installed and mounted directly on the pumping unit.

Advantages of network pumping units:
- auto on/auto-off operation
- reduced pump running time
- reduced energy consumption
- increased life time of wear parts

Installation Notes

- **Pumping unit connections:** The network pumping units already have the necessary adapters and /or connectors; adapters may be necessary when using pumps not originally intended for use in a network application.

- **Tube:** tubing lengths are based on best estimates from plan and do not allow for discrepancies or cutting errors on site.

- **Cooling water supply and drainage (If specified):**
  VACUUBRAND network (LAN) pumping units are provided with a tap-water-cooled emission condenser (EK) standard. The condenser allows virtually all solvent vapors to be condensed and collected at the pump for recycling or proper disposal. A water solenoid valve is recommended for all VACUU·LAN® networks to minimize water consumption at the emission condenser.
  - For the VARIO design pumps, this is a 24V solenoid which is powered from the pump.
  - For the standard VACUUBRAND pumping units, the solenoid uses line voltage, This requires a standard electrical socket, which ideally is controlled (along with the pump electrical supply) by an above-bench fused switch.

  For both models a water supply with adjustable flow, (0.5 to 2 liters per min), is required locally to the pump position, which terminates in a 3/4" ball-fix valve, to which the water solenoid valve is affixed, and is connected, in turn, to the pump condenser. A drain is also needed close to the pump.
  Note: There is no provision in VACUUBRAND quotations for the installation of the water and drainage lines, nor for connection between the pump and the water solenoid.

- **Peltronic™ Electrical Condenser (If specified):**
  In cases in which water supply and drain are not available (such as in mobile lab casework), or the user prefers to avoid cooling water consumption, electronically cooled Peltronic™ condensers are available from VACUUBRAND. The Peltronic condenser is a solid state device based on Peltier elements. If chosen as an option, this approach requires a single electrical socket for power, which is switched with the pump from a single fused spur. The Peltronic condenser requires no water or drain connection, but the pump should still be exhausted to ducting. It eliminates water consumption and the risk of cooling water release, and uses very little electricity (7-160 W).

- **Power supply:**
  A double socket is required within the pump cabinet: one for the water solenoid valve/ Peltronic condenser (as above) and one for the pump unit. A socket is also required somewhere within the fume hood cabinets/cupboards if they are outfitted with electronic controllers. Note: All electrical work is to be provided by others.
  For the pumping unit, a socket with switch and fuse is recommended. LAN pumping units switch themselves on and off automatically, so only a standard socket is needed.

- **Pump location and housing requirements:**
  - The pumps should be located as central to the network as possible.
  - When a pump is installed in a cabinet, heat build-up can cause the pumps to cut out, and also reduce the efficiency of the exhaust gas condenser. Cupboard backs should be removed, and the door removed or fitted with louvered panels. Mechanically vented cupboards are ideal, with a 50 mm duct connection into which an exhaust tube can be fed. If both pump and Peltronic™ condenser are built into furniture, extra care should be taken to ensure heat build-up does not cause the pump to cut-out. Additional ventilation to that already mentioned above may be required. **The maximum operating temperature at the pump should not exceed 40°C; this should be monitored during use.**

  Note: Furniture, ducting, louvers and cut-outs to cupboards are the responsibility of others.

  The user is required to regularly check the catchpots at the pump, so access and visibility of the unit should be a priority. A liquid level sensor is suggested for the exhaust catchpot.

  Where the tubing has to cross from one island bench to another, the run should be high and short. Tubing should not be run under the floor, as this encourages condensation by acting as a u-bend.

- **Assembly onto furniture:**
  For fume-hood outlets it is expected those would be provided free issue into the fume cupboard. This modular concept allows the preintegration into the cupboard during assembly in the factory of the cupboard manufacturer. The later on-site connection of furniture modules can be easily done then.
  Note: Pre-installation of vacuum ports and controls is strongly recommended, for reasons of workmanship and access on site.
  Note: Bench outlet positions should be pre-drilled by the bench manufacturer.
  For bench-mounted and fume cupboard installations, VACUUBRAND will provide a drill plan.

3.2 Chemistry Vacuum Systems

VACUUBRAND offers a wide range of oil-free vacuum pumps suitable for use with VACUU·LAN® local vacuum networks. Select the pump that suits the size of your network, and your preferences regarding vacuum performance, control, convenience and budget.

MZ 2C NT +2AK Chemistry Vacuum System – our most economical choice

This chemistry vacuum system has a wide range of applications in laboratories where there is no need for an emission condenser to capture solvent vapors at the outlet. The separator at the inlet (AK), made of glass with protective coating, retains particles and liquid droplets, protecting pump performance. The separator at the outlet collects condensate, avoids condensate backflow towards the pump, and makes this quiet pump even quieter.	

Based on the MZ 2C NT chemistry diaphragm pump:

pumping speed (ISO 21360):

max.:	2.0/2.3 m^3/h (50/60 Hz)
ultimate vacuum without gas ballast:	7 mbar / 5 Torr
ultimate vacuum with gas ballast:	12 mbar / 9 Torr

Pumping unit:

connections	
inlet (IN):	hose nozzle DN 10 mm (adapter cat.no. 637873 is needed)
outlet (EX):	hose nozzle DN 10 mm
motor power:	0.18 kW
CE-conformity:	machine directive, low-voltage directive, electromagnetic compatibility directive
certification (NRTL):	C/US
dimensions (LxWxH):	319 x 242 x 309 mm
weight:	13.6 kg

Items supplied:

Chemistry diaphragm pump MZ 2C NT mounted on pump support. Catchpots at inlet (hose nozzle DN 10 mm) and at outlet. On/off switch, cable with plug and instructions for use.

230V ~50-60Hz	cat.no. 732500 (CEE plug)
100-120V ~ 50-60 Hz	cat.no. 732503 (US plug)

More information is available in our 2008/2009 catalog, "Technology for Vacuum Systems," pp. 36 and at www.vacuubrand.com

The special advantages of the MZ 2C NT +2AK chemistry pumping unit

- chemistry diaphragm pump with a highly chemical-resistant flowpath
- oil-free vacuum down to 7 mbar / 5 Torr
- excellent pumping speeds even at low vacuum
- gas ballast for working with condensable vapors
- catchpots for reliable, convenient operation with condensates
- exceptionally low noise level
- compact design
- long lifetime of diaphragms and valves – typical service intervals of 10,000+ operating hours

MD 4C NT +2AK Chemistry Vacuum System – Extra vacuum capacity and pumping speed

This chemistry vacuum system has a wide range of applications in laboratories where there is no need for an emission condenser to capture solvent vapors at the outlet. This system is well proven for vacuum applications with high-boiling solvents. The separator at the inlet (AK), made of glass with a protective coating, retains particles and liquid droplets to protect pump performance. The catchpot at the outlet collects condensate, avoids condensate backflow towards the pump, and reinforces the whisper-quiet operation of the pump.

Based on the MD 4C NT chemistry diaphragm pump

pumping speed (ISO 21360):

max.:	3.4/3.8 m^3/h (50/60 Hz)
ultimate vacuum without gas ballast:	1.5 mbar / 1.1 Torr
ultimate vacuum with gas ballast:	3 mbar / 2.3 Torr

Pumping unit:

connections	
inlet (IN):	hose nozzle DN 10 mm (adapter cat.no. 637873 is needed)
outlet (EX):	hose nozzle DN 10 mm
power supply:	230 V ~ 50-60 Hz
motor power:	0.25 kW
CE-conformity:	machine directive, low-voltage directive, electromagnetic compatibility directive
certification (NRTL):	C/US
dimensions (LxWxH):	319 x 242 x 374 mm
weight:	16.7 kg

Items supplied:

Chemistry diaphragm pump MD 4C NT mounted on pump support. Catchpots at inlet (hose nozzle DN 10 mm) and at outlet. on/off switch, cable with plug and instructions for use.

230V ~50-60Hz	cat.no. 736600 (CEE plug)
100-120V ~ 50-60 Hz	cat.no. 736603 (US plug)

More information is available in our 2008/2009 catalog, "Technology for Vacuum Systems," pp. 54 and at www.vacuubrand.com

The special advantages of the chemistry pumping unit MD 4C NT AK+2AK:

- chemistry diaphragm pump with a highly chemical-resistant flowpath
- oil-free vacuum down to 1.5 mbar / 1.1 Torr
- excellent pumping speeds even at low vacuum
- gas ballast for working with condensable vapors
- catchpots for reliable, convenient operation with condensates
- exceptionally low noise level
- compact design
- long lifetime of diaphragms and valves – typical service intervals of 10,000+ operating hours

MZ 2C NT +AK+EK Chemistry Vacuum System – affordable GREEN vacuum supply

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

Based on the MZ 2C NT chemistry diaphragm pump

pumping speed (ISO 21360):	
max.:	2.0/2.3 m^3/h (50/60 Hz)
ultimate vacuum without gas ballast:	7 mbar / 5 Torr
ultimate vacuum with gas ballast:	12 mbar / 9 Torr

Pumping unit:

connections	
inlet (IN):	hose nozzle DN 10 mm (adapter cat.no. 637873 is needed)
outlet (EX):	hose nozzle DN 10 mm
coolant:	hose nozzle DN 6-8 mm
motor power:	0.18 kW
CE-conformity:	machine directive, low-voltage directive, electromagnetic compatibility directive
certification (NRTL):	C/US
dimensions (LxWxH):	326 x 242 x 402 mm
weight:	14.2 kg

Items supplied:
Chemistry diaphragm pump MZ 2C NT mounted on pump support. Catchpot at inlet (hose nozzle DN 10 mm) and exhaust waste vapor condenser at outlet. On/off switch, cable with plug and instructions for use.

230V ~50-60Hz	cat.no. 732600 (CEE plug)
100-120V ~ 50-60 Hz	cat.no. 732603 (US plug)

More information is available in our 2008/2009 catalog, "Technology for Vacuum Systems," pp. 37 and at www.vacuubrand.com

The special advantages of the chemistry pumping unit MZ 2C NT +AK+EK:

- chemistry diaphragm pump with a highly chemical-resistant flowpath
- oil-free vacuum down to 7 mbar / 5 Torr
- excellent pumping speeds even at low vacuum
- gas ballast for working with condensable vapors
- near-100% solvent recovery, and catchpots for convenient operation with condensates
- exceptionally low noise level
- compact design
- long lifetime of diaphragms and valves – typical service intervals of 10,000+ operating hours

MD 4C NT +AK+EK Chemistry Vacuum System – GREEN vacuum supply; extra capacity

This whisper-quiet chemistry diaphragm pump is suited for vacuum applications with high boiling solvents. The separator at the inlet (AK), made of glass with a protective coating, retains particles and liquid droplets to protect pump performance. The waste vapor condenser at the outlet (EK) is highly efficient and compact. The condenser enables near-100-percent solvent recovery and efficient solvent recycling, while actively protecting the lab atmosphere and external environment from exhaust emissions

Based on the MD 4C NT chemistry diaphragm pump

pumping speed (ISO 21360):	
max.:	3.4/3.8 m³/h (50/60 Hz)
ultimate vacuum without gas ballast:	1.5 mbar / 1.1 Torr
ultimate vacuum with gas ballast:	3 mbar / 2.3 Torr

Pumping unit:

connections	
inlet (IN):	hose nozzle DN 10 mm (adapter cat.no. 637873 is needed)
outlet (EX):	hose nozzle DN 10 mm
coolant:	hose nozzle DN 6-8 mm
power supply:	230 V ~ 50-60 Hz
motor power:	0.25 kW
CE-conformity:	machine directive, low-voltage directive, electromagnetic compatibility directive
certification (NRTL):	C/US
dimensions (LxWxH):	326 x 242 x 402 mm
weight:	17.3 kg

Items supplied:
Chemistry diaphragm pump MD 4C NT mounted on pump support. Catchpot at inlet (hose nozzle DN 10 mm) and exhaust waste vapour condenser at outlet. on/off switch, cable with plug and instructions for use.

230V ~50-60Hz	cat.no.	736700 (CEE plug)
100-120V ~ 50-60 Hz	cat.no	736703 (US plug)

More information is available in our 2008/2009 catalog, "Technology for Vacuum Systems," pp. 55 and at www.vacuubrand.com

The special advantages of the MD 4C NT +AK+EK chemistry pumping unit:

- chemistry diaphragm pump with a highly chemical-resistant flowpath
- oil-free vacuum down to 1.5 mbar / 1.1 Torr
- excellent pumping speeds even at low vacuum
- gas ballast for working with condensable vapors
- near-100% solvent recovery, and catchpots for convenient operation with condensates
- exceptionally low noise level
- compact design
- long lifetime of diaphragms and valves – typical service intervals of 10,000+ operating hours

3.3 LAN Network Vacuum Pumping Units

PC 500 LAN NT Network Vacuum Pumping Unit

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 vapor condenser. VNC 2 also includes readout of the liquid level detection sensor

Based on the MZ 2C NT chemistry diaphragm pump

pumping speed (ISO 21630):	
max.:	2.0/2.3 m^3/h (50/60 Hz)
ultimate vacuum without gas ballast:	7 mbar / 5 Torr
ultimate vacuum with gas ballast:	12 mbar / 9 Torr

VNC 2 Vacuum Controller

measuring range:	1100 - 1 mbar (hPa), 825 - 1 Torr
display:	digital, user selectable pressure units (mbar, Torr and hPa)
measuring principle:	capacitive, gas type independent
uncertainty of measurement:	1 mbar (+/- 1 digit, after proper zero and atmospheric point setting and at constant temp.)
temperature coefficient: <0.07 mbar/K	
transducer:	integrated, capacitive, made of alumina ceramic

Pumping unit:

connections:	
inlet (IN):	connection for PTFE-tube DN 10/8 mm
outlet (EX):	hose nozzle DN 10 mm
coolant:	2 x hose nozzle DN 6-8 mm
dimensions (LxWxH):	408 x 264 x 402 mm
weight:	15.3 kg

Items supplied:
Chemistry Pumping Unit with MZ 2C NT chemistry diaphragm pump on pump support, anti-implosion coated inlet catchpot, outlet emission condenser with catchpot, vacuum controller VNC 2, on/off switch, cable, plug and instructions for use.

230V ~50-60Hz	cat.no.	733400 (CEE plug)
100-120V ~ 50-60 Hz	cat.no	733403 (US plug)

More information is available in our 2008/2009 catalog,
"Technology for Vacuum Systems," pp. 41 and at www.vacuubrand.com

The special advantages of the PC 500 LAN NT chemistry pumping unit:

- chemistry diaphragm pump with high chemical resistant materials
- oil free vacuum down to 7 mbar / 5 Torr
- auto-on/auto-off operation
- high pumping speed even at low vacuum
- gas ballast standard for working with condensable vapors
- near-100% solvent recovery, and catchpots for convenient operation with condensates
- minimal energy consumption due to automatic pump management
- exceptionally low noise level
- compact design
- long lifetime of diaphragms and valves – typical service intervals of 10,000+ operating hours

PC 600 LAN NT Network Vacuum Pumping Unit – for larger networks and applications

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 vapor condenser. VNC 2 also includes readout of the liquid level detection sensor

Chemistry diaphragm pump MD 4C NT

pumping speed (ISO 21360):	
max.:	3.4/3.8 m³/h (50/60 Hz)
ultimate vacuum without gas ballast:	1.5 mbar / 1.1 Torr
ultimate vacuum with gas ballast:	3 mbar / 2.3 Torr

Vacuum Controller VNC 2

measuring range:	1100 - 1 mbar (hPa), 825 - 1 Torr
display:	digital, user selectable pressure units (mbar, Torr and hPa)
measuring principle:	capacitive, gas type independent
uncertainty of measurement:	1 mbar (+/- 1 digit, after proper zero and atmospheric point setting and at constant temp.)
temperature coefficient: <0.07 mbar/K	
transducer:	integrated, capacitive, made of alumina ceramic

pumping unit:

connections	
inlet (IN):	connection for PTFE–Rohr DN 10/8 mm
outlet (EX):	hose nozzle DN 10 mm
coolant:	2 x hose nozzle DN 6-8 mm
dimensions (LxWxH):	408 x 264 x 470 mm
weight:	18.4 kg

Items supplied:
Chemistry Pumping Unit with MD 4C NT chemistry diaphragm pump on pump support, anti-implosion-coated inlet catchpot, outlet emission condenser with catchpot, VNC 2 vacuum controller, on/off switch, cable, plug and instructions for use.

230V ~50-60Hz	cat.no. 737400 (CEE plug)
100-120V ~ 50-60 Hz	cat.no. 737403 (US plug)

More information is available in our 2008/2009 Catalog, "Technology for Vacuum Systems," pp. 58 and at www.vacuubrand.com

The special advantages of the PC 600 LAN NT chemistry pumping unit:

- chemistry diaphragm pump with high chemical resistant materials
- oil free vacuum down to 1.5 mbar / 1.1 Torr
- auto-on/auto-off operation
- high pumping speed even at low vacuum
- gas ballast standard for working with condensable vapors
- near-100% solvent recovery, and catchpots for convenient operation with condensates
- minimal energy consumption due to automatic pump management
- exceptionally low noise level
- compact design
- long lifetime of diaphragms and valves – typical service intervals of 10,000+ operating hours

PC 500 LAN NT EK-Peltronic Network Vacuum Pumping Unit – Vapor capture without coolants

This ready-to-connect chemistry vacuum pumping unit features the same vacuum and control benefits as the PC 500 LAN NT pumping unit, but replaces the water-cooled condenser of the PC 500 LAN NT with an electronically cooled exhaust vapor condenser.
The Peltronic™ exhaust vapor condenser eliminates the need for external coolants such as water or dry ice to condense solvent vapors. Peltier elements are used as a cooling system. All wetted parts are highly chemical resistant.
The condenser is ideally suited for applications where cooling water is not available or desired because of environmental reservations about water use, cost and productivity concerns associated with dry ice condensers, or risk of flooding from cooling water plumbing leakage. This often is requested for vacuum networks built into lab furniture, and for moveable casework.

For specifications of the integrated MZ 2C NT pump and VNC 2 vacuum controller, please see the description of the PC 500 LAN NT Network Vacuum Pumping Unit in Section 3.3.1.

pumping unit:

connections	
inlet (IN):	connection for PTFE–Rohr DN 10/8 mm
outlet (EX):	hose nozzle DN 10 mm
dimensions (LxWxH):	442 x 326 x 392 mm
weight:	approx. 20 kg

Items supplied:
Chemistry Pumping Unit with MZ 2C NT chemistry diaphragm pump on pump support, anti-implosion-coated inlet catchpot, Peltronic™ outlet emission condenser with catchpot, VNC 2 vacuum controller, on/off switch, cable, plug and instructions for use.

100-120V ~ 50-60 Hz cat.no. *on request* (US plug)

More information is available in our 2008/2009 Catalog, "Technology for Vacuum Systems," pp. 41 & pp. 77, or at www.vacuubrand.com

The special advantages of the PC 500 LAN NT EK-Peltronic chemistry pumping unit:

- chemistry diaphragm pump with high chemical resistant materials
- oil free vacuum down to 7 mbar / 5 Torr
- auto-on/auto-off operation
- high pumping speed even at low vacuum
- gas ballast standard for working with condensable vapors
- near-100% solvent recovery with coolant-free Peltronic™ condenser
- minimal energy consumption due to automatic pump management
- exceptionally low noise level
- compact design
- long lifetime of diaphragms and valves – typical service intervals of 10,000+ operating hours

PC 600 LAN NT EK-Peltronic Network Vacuum Pumping Unit – Vapor capture without coolants

This ready-to-connect chemistry vacuum pumping unit features the same vacuum and control benefits as the PC 600 LAN NT pumping unit, but replaces the water-cooled condenser of the PC 600 LAN NT with an electronically cooled exhaust vapor condenser.
The Peltronic™ exhaust vapor condenser eliminates the need for external coolants such as water or dry ice to condense solvent vapors. Peltier elements are used as a cooling system. All wetted parts are highly chemical resistant.
The condenser is ideally suited for applications where cooling water is not available or desired because of environmental reservations about water use, cost and productivity concerns associated with dry ice condensers, or risk of flooding from cooling water plumbing leakage. This often is requested for vacuum networks built into lab furniture, and for moveable casework. The figure shows a unit with liquid level sensor at the neck of the condenser catchpot (optional, on request).

For specifications of the integrated MD 4C NT pump and VNC 2 vacuum controller, please see the description of the PC 600 LAN NT Network Vacuum Pumping Unit in Section 3.3.2. All other previously mentioned chemistry vacuum systems and pumping units are available with Peltronic™ condensers, on request.

pumping unit:

connections	
inlet (IN):	connection for PTFE–Rohr DN 10/8 mm
outlet (EX):	hose nozzle DN 10 mm
dimensions (LxWxH):	442 x 326 x 470 mm
weight:	approx. 23 kg

Items supplied:
Chemistry Pumping Unit with MZ 2C NT chemistry diaphragm pump on pump support, anti-implosion-coated inlet catchpot, Peltronic™ outlet emission condenser with catchpot, VNC 2 vacuum controller, on/off switch, cable, plug and instructions for use.

100-120V ~ 50-60 Hz cat.no. *on request* (US plug)

More information is available in our 2008/2009 Catalog,
"Technology for Vacuum Systems," pp. 58 & pp. 77, or at www.vacuubrand.com

The special advantages of the PC 600 LAN NT EK-Peltronic chemistry pumping unit:

- chemistry diaphragm pump with high chemical resistant materials
- oil free vacuum down to 1.5 mbar / 1.1 Torr
- auto-on/auto-off operation
- high pumping speed even at low vacuum
- gas ballast standard for working with condensable vapors
- near-100% solvent recovery with coolant-free Peltronic™ condenser
- minimal energy consumption due to automatic pump management
- exceptionally low noise level
- compact design
- long lifetime of diaphragms and valves – typical service intervals of 10,000+ operating hours

3.4 Accessories for Chemistry Pumping Units / Systems

VNC 2 Vacuum Network Controller

The VNC 2 Vacuum Network Controller enables automatic on/off control of a vacuum network in response to vacuum demand. The integrated pressure transducer is chemical resistant, and offers outstanding measuring accuracy independent of gas type.
The device is designed for precise and reliable control of recurrent routine jobs that do not require regular adjustment. The VNC 2 vacuum controller can only be used to control components compatible with the VACUU·BUS™ system. Special versions of the controller, e.g., for mounting in laboratory furniture, are available. Further information is available on request.

Vacuum controller VNC 2
vacuum measurement and control

measuring range:	1100 - 1 mbar (hPa), 825 - 1 Torr
vacuum control range:	1100 - 1 mbar
display:	digital; menu guided, user selectable pressure units (mbar, Torr and hPa)
measuring principle:	capacitive, gas type independent
uncertainty of measurement:	< 1 mbar (+/- 1 digit, after proper zero and atmospheric point setting and at constant temp.)
temperature coefficient:	< 0.07 mbar/K
transducer:	integrated, made of alumina ceramic
inlet connection (IN):	connection for PTFE-tube DN 10/8 mm and hose nozzle for 6/10mm i.d. tubing
connections:	
interface:	RS 232C
valves, sensors:	2 x VACUU·BUS™
power supply:	100-230 V ~ 50-60 Hz
degree of protection:	IP 20 / front side of built in-versions IP 54
dimensions (LxWxH):	163 mm x 90 mm x 68 mm
weight:	0.8 kg

cat.no. 683070 (Workstation controller stand alone, built-in versions on request)
power cord to be ordered separately

The special advantages of the VNC 2 vacuum controller are:
- precise and stable vacuum gauge; transducer made of alumina-ceramic
- on-demand control of process vacuum, cooling water and venting
- compact design
- menu-guided operation
- especially suited (special program) for operating vacuum networks like VACUU·LAN®
- selectable acoustic alert signals

more information is available in our 2008/2009 catalog,
“Technology for Vacuum Systems,” pp. 144 and at www.vacuubrand.com

Power Cables and coolant valves

Power cable 230 V, CEE
length: 2000 mm
cat.no. 612058

Power cable 230 V, CH
length: 2500 mm
cat.no. 676021

Power cable 230 V, UK
length: 2500 mm
cat.no. 676020

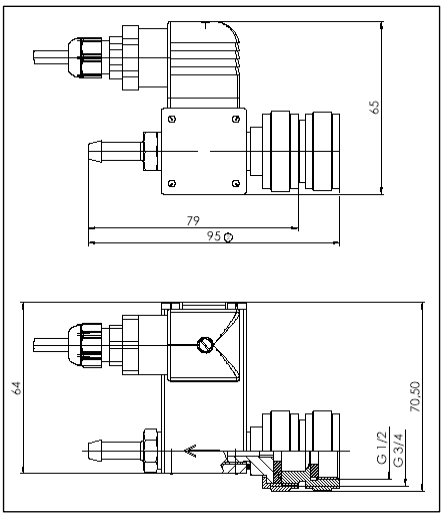
Power cable 120 V, US
length: 2500 mm
cat.no. 612065

Coolant valves

When the emission condenser of a pumping unit is used with tap water or a coolant circuit, the vacuum controller can switch an additional coolant valve.
The 24 V DC coolant valve can be operated directly through a VACUU·BUS™ connection from the CVC 3000 or VNC 2 controllers. The coolant valves are equipped with various adaptors and hose nozzles to fit to the common installation standards.

Coolant valve 24 V/=

liquid connections:	
inlet:	G 3/4“/ G1/2“ (adaptor)
outlet:	hose nozzle DN 6/10 mm
electr. connection	VACUU·BUS™
	cat.no. 674220



4 VACUU·LAN® Tubing

4.1 Individual Parts of the VACUU·LAN® Tubing

The connection between the different vacuum network (VCL) modules is made with PTFE tube. PTFE tube, being rather stiff, does not allow a small bending radius. Be careful to prevent kinks! For different situations, T-pieces, angled and straight connectors are available.

1. VCL-PTFE-tube DN 10/8 mm	cat.no. 63 86 44 (one meter)
2. VCL-elbow union DN 10/8 mm	cat.no. 63 84 34
3. VCL-T-union DN 10/8 mm	cat.no. 63 84 35
4. VCL-straight-union DN 10/8 mm	cat.no. 63 99 90

(see chapter: **Overview: VACUU·LAN® Adaptors and -Connectors**)

4.2 Remarks on the Vacuum-Tubing

For simple and cost effective network assembly, as well as a reliable vacuum network, the following remarks on the vacuum-tubing are important:

- Use ID 8 mm (OD 10 mm) PTFE tubing, with surface quality properly matched to the connection parts to ensure vacuum-tight connections
  - larger ID tubing will slow the response of the network's non-return valves, reducing the ability of the VACUU·LAN® network to protect vacuum applications from instability caused by other operations on the network;
  - smaller ID tubing will reduce the effective pumping speed at the vacuum modules because of insufficient flow through the network.

- All connection parts must be assembled securely. See "Making a VACUU·LAN® Tubing Connection," Appendix pp. 46

- All parts that have contact with pumped gases must have very good chemical resistance. Note: We strongly discourage the use of copper tubing in vacuum networks.

- Fittings used with PTFE tubing on VACUU·LAN® networks are intended for one-time use in order to ensure a leak-tight connection. If you need to break a connection, we recommend replacing the fitting to ensure a good seal.

We recommend the use of VACUUBRAND PTFE tubing, tempered to ensure long life reliability

5 Vacuum Connections

5.1 General Design

VACUU·LAN® - VCL modules are completely pre-assembled and ready for installation. For new lab furniture, the A5 base (mounting base) provides a neat installation with concealed tubing. For retrofitting installations into existing labs or lab renovations where furniture will not be replaced, the A1 mounting base for the vacuum modules offers the option of convenient surface-mounting.

Every VACUU·LAN® VCL module consists of at least 3 parts:

one **mounting base** (A), with connections for tubing

one **module body** (B)

one or more **functional elements** (C or D)

Choosing the correct **VACUU·LAN®** modules involves answering the following questions.

What vacuum processes need to be controlled?
For example,
- filtration (simple control) vs. evaporator (more complex vacuum management)
- the size/volume of application: for very small vessels or application volumes, a manual flow control is recommended; for larger volumes, a shut-off valve should be added.

What control devices (functional elements) are needed for the desired control of the vacuum processes?
There are three main control possibilities (functional elements):
1. shut off control (with ball valve D1 or D2)
2. flow control (with manual flow control part C2)
3. automatic vacuum control (with solenoid valve C3B)

Each vacuum module will include one of these control approaches, or a combination, such as a flow control valve and shut off valve in combination.

How will the vacuum modules be mounted, and into what furniture?
- built-in application or surface mounted?
- integration of the network before installation of laboratory furniture, or after?
- type of laboratory furniture (e.g., benches or fume hoods)?

VACUUBRAND offers a very wide array of combinations of mounting bases, module bodies and functional elements. The combination defines the catalog number used for ordering. Many of the options for mounting bases, module bodies and functional elements are described in Chapter 7, and many others exist which may be helpful for design of specialized requirements.

For practical purposes, however, most VACUU·LAN® networks are equipped with one of a limited array of modules that are described here. For other options, please contact VACUUBRAND to let us know your needs. With hundreds of networks installed world-wide, working with a diverse group of fume hood and case work manufacturers, there is an excellent chance that we have the exact combination of parts that you need.

5.2 VACUU·LAN® Modules

VACUU·LAN® modules have the following advantages:

- **Versatile, economical vacuum supply**
  several work stations are supported by one vacuum pump
- **personalized connection**
  choice of vacuum control capabilities at the individual work station
- **integrated non-return valves**
  reduce interference or cross contamination, even at low pressure differential, and reduce total system pumping speed and flow-rate requirements
- **proven user-friendly installation**
  panel mounted (tubing & connections concealed) or surface mounted (e.g., retrofitting)
- **flexible design, modular system**
  easy network modification to adapt to changes in vacuum requirements or workstation needs
- **easy cleaning, easy changing elements**
  no tools necessary for opening/closing of the modules
- **leak-tested modules, ready for use**
  when your connections are tight, the vacuum network is ready to use

Note: components referenced in each description are described in Chapter 7.

VACUU·LAN® VCL 01 Manual Flow Control Module

VCL 01 is a combination of module body B1 (with DN 6/10 hose nozzle) and functional element C2 that provides manual flow control and shut-off. The manual flow control module is leak tested and ready to use. with mounting base A1 (surface mount): cat.no. 677106 (picture) with mounting base A5: (concealed tubing) cat.no. 677190	

VACUU·LAN® VCL 02 Shut off-/Manual Flow Control Module

VCL 02 is a combination of module body B1 (with DN 6/10 hose nozzle) and functional elements C2 (manual flow control) and D1 (shut-off valve). Advantage: pre adjusted flow is not influenced by shutting on/off. The shut off-/manual flow control module is supplied ready for use and leak tested. with mounting base A1 (surface mount): cat.no. 677107 with mounting base A5: (concealed tubing) cat.no. 677191 (picture)	

VACUU·LAN® VCL-B 10 Automatic Control Module

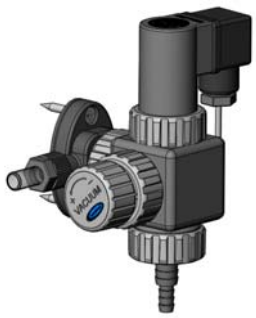
VCL 10 is a combination of module body B1 (with DN 6/10 hose nozzle) and functional element C3B (solenoid valve). The C3B solenoid chemistry valve (connected to a vacuum controller) provides exact vacuum control. The automatic control module is ready for use and leak tested. Controlled via VACUUBRAND VACUU-BUS® connection. with mounting base A1(surface mount): cat.no. 677208 with mounting base A5 (concealed tubing): cat.no. 677292	

VACUU·LAN® VCL-B 11 Automatic Control / Manual Flow Control Module

VCL-B 11 combines module body B2 (with DN 6/10 hose nozzle), flow control part C2 and solenoid chemistry valve C3B. The VCL-B 11 module provides (in combination with a vacuum controller) automatic vacuum control and flow regulation, e.g. for reducing pumping speed for sensitive processes. Controlled via VACUUBRAND VACUU·BUS™ connection.

The automatic control- / manual flow control module is ready for use and leak tested.

with mounting base A1 (surface mount): cat.no. 677209
with mounting base A5: (concealed tubing): cat.no. 677293



VACUU·LAN® VCL K Shut-Off Module

VCL K is a combination of module body B1 (with DN 6/10 hose nozzle), blank flange C1, and D1 shut-off valve for quick opening or closing of a vacuum line.
The shut off module is ready for use and leak tested.

with mounting base A1 (surface mount): cat.no. 677155 (picture)
with mounting base A5 (concealed tubing): cat.no. 677194

VACUU·LAN® VCL RMS manual flow control-/ vacuum gauge for side panels

The VCL RMS is an add-on module without mounting base. Based on a B1 module body (with DN 6/10 hose nozzle), it is used to add manual flow control and a vacuum gauge to mounting bases that are already in place. This module is convenient when mounted on side panels inside or outside an fume hood. The VCL RMS provides reliable and precise manual vacuum control; the manometer offers an analog vacuum display. The manual flow control and vacuum indication module is leak tested. (Image rotated 180° to show end that mounts on mounting base.)

mounting: May be mounted on A1 or A5 mounting bases

with module body B1, without mounting base: cat.no. 2612120

VACUU·LAN® VCL AR Manual Flow Control Module for Hoods

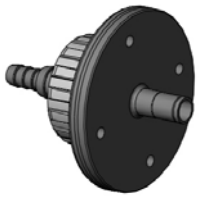
The VCL AR combines a manual flow control module for mounting outside the hood with a separate vacuum nozzle for installation inside the hood. The VCL AR provides reliable and precise vacuum control without opening or manipulating inside the hood.
The manual flow control module for hoods is leak-tested and ready for use.

Several mounting options are available. Most common configurations include:

- with mounting base A5 and module body B8: cat.no. 677195
  providing for wall/surface mounting with unlimited wall thickness, and secured with 4 screws, 3.9 x 13 mm
  network connection via 2 included compression fittings for DN 10/8 PTFE tube (B8) and connection **for** compression fitting for DN 10/8 (A5)

- with mounting base A3 on request: cat.no. *on request*
  providing mounting into a threaded 3/8” socket in lab furniture or walls
  network connection at the A3: G 3/8" internal thread (A3)
  (G is identical to dimensions according to BST)

677195, A5/hose nozzle C9 + B8/C2



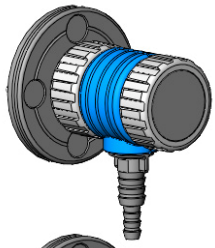
A5 back view (A5/C9)

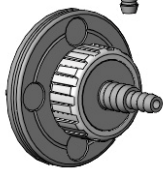
VACUU·LAN® Automatic Control Module VCL-B AE for Hoods

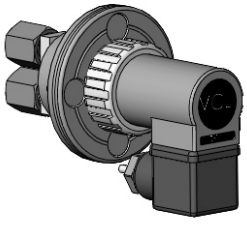
The VCL-B AE is a combination of an automatic vacuum control module for mounting outside the hood and two separate vacuum units (one for measuring and one for vacuum connection) for installation inside the hood. The VCL-B AE provides (in combination with a vacuum controller) automatic vacuum control without opening or manipulating inside the hood.
The automatic control module for hoods is leak-tested and ready for use.

Several mounting options are available for the VCL-B AE control module. Most common configuration include:

- with mounting base A5 and module body B8: cat.no. 677296
  providing for wall/surface mounting with unlimited wall thickness, and secured with 4 screws, 3.9 x 13 mm
  network connection via 2 included compression fittings for DN 10/8 PTFE tube (B8) and connection **for** compression fitting for DN 10/8 (A5); electrical connection via VACUU·BUS™







VACUU·LAN® VCL A Module for Hoods with built-in vacuum controllers

The VCL A combines a DN 6/10 hose nozzle and mounting base for use inside hoods with built-in vacuum controllers. The VCL A with A5 mounting base has only a straight hose nozzle (DN 6/10) by the functional element C9 (C9 not available separately) and has to be combined with an additional module offering a certain function. Further it can be used as a separate measurement connection for stand-alone vacuum gauges or controllers.

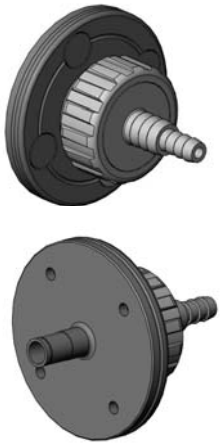
Other options are available for mounting with 3/8" threaded sockets or with a threaded feed-through for walls up to 18 mm, secured with a 24 mm hexagon nut.

The VCL A module has no non-return valve. It is supplied leak-tested and ready for use.

The VCL A Module for hoods is supplied:
mounting:

- with mounting base A5: cat.no. 677167
  wall mounting, wall thickness not limited, secured with
  4 screws 3.9 x 13 mm
  network connection **for** compression fitting for DN 10/8 (A5)

VCL A is available with other mounting bases. Call for details.



A5/hose nozzle C9

5.3 Accessories for VACUU·LAN® Modules

Vacuum Connections and -Adaptors for VACUU·LAN® Modules

For the installation of A5mounting bases, the following fittings are necessary. No additional fittings necessary for installation of A1 mounting base:

1. VCL-elbow union DN 10/8 mm cat.no. 638434 or
2. VCL-straight union DN 10/8 mm cat.no. 639990

Note:

- use straight or elbow fittings depending on installation direction of vacuum tube
- use adhesive or Teflon® tape on fitting threads

Workstation Vacuum Controller CVC 3000

The CVC 3000 automatically adjusts the vacuum level at a VACUU·LAN® workstation to the process demands by controlling vacuum pumps and solenoid valves. Installation of CVC 3000 controllers at a VACUU·LAN® workstation permits delivery of individualized vacuum at that station.

The integrated venting valve and a highly resistant alumina ceramic vacuum sensor ensure excellent measuring reliability independent of gas type. Ten fully configurable programs can also be edited and stored easily. Each program can include up to ten time and pressure steps, with control functions such as venting, pumping and vacuum ramp. External valves and gauge heads connect simply and are recognized automatically via the VACUU·BUS™ control system. The controller provides improved process control and environmental protection with increased solvent recovery, reduction of foaming and boiling retardation. Even with unknown mixtures and pressures, the optimal evaporation vacuum can be found easily and quickly. The CVC 3000 also manages cooling water flow to pump emission condensers.

Vacuum Controller CVC 3000

Upper measuring limit:	1080 mbar (hPa), 810 torr
Lower measuring limit:	0.1 mbar (hPa), 0.1 torr
Measurement principle	Capacitive, gas-type independent, absolute pressure
Measurement uncertainty	< +- 1 mbar/hPa/torr +- 1 digit (after adjustment, constant temperature)
Temperature coefficient	< 0.07 bar/hPa/torr /°C
Vacuum connection	PTFE-tubing conn. 10/8 mm with hose nozzle DN 6/10 mm
Venting valve connection	integrated hose nozzle DN 4-5 mm
interface:	RS 232 C, VACUU·BUS™
Ambient temperature range (operation)	-10 – 60 °C
Ambient temperature range (storage)	10 – 40 °C
Max media temp. cont. operation	40 °C
Max media temp. for short times	80 °C
Degree of protection	IP 20
Degree of protection	IP 40 (front side of display unit)
Cable length of external power supply:	2 m
Dimensions (L x W x H)	138 x 124 x 115 mm
Weight	0.44 Kg

cat.no. 683160 100-230V ~50-60Hz CEE/CH/UK/US/AUS

The special advantages of the Vacuum Controller CVC 3000:

- controls process vacuum, cooling water, and venting on demand
- analog and digital pressure display: clear trend indication; easy to read, precise read out
- intuitive operation with turn-and-tap jog wheel and clear text menus, with integrated venting valve
- manual/semi-automatic determination of vacuum setting
- automatic setting of pressure intervals, manual override
- reduced foam formation due to fast valve response
- electronically selectable vacuum units (Torr, mbar, hPa)

More information is available in our 2008/2009 catalog, "Technology for Vacuum Systems," pp. 142 and at www.vacuubrand.com

Workstation Vacuum Controller CVC 3000E for integration into laboratory furniture

VACUUBRAND offers easily adaptable built-in versions of the CVC 3000 controller for vacuum networks integrated into laboratory furniture. The built-in version features an in-line solenoid vacuum valve mounted directly to the rear of the controller, with an integrated check valve included to avoid interference and contamination among neighboring work stations. The layout and installation of the built-in controllers can be easily accomplished by lab furniture manufacturers prior to delivery to the work site. VACUU·BUS™ connections including sensor cables may be extended up to 30 m. An external vacuum gauge head with ceramic sensor (VSK 3000) is available as an accessory for vacuum measurement directly at the process workstation.

For complete specifications of Workstation Controller CVC 3000E, please see Section 5.3.2, Workstation controller CVC 3000

Vacuum connection	2 x PTFE-tubing conn. DN 10/8 mm
Dimensions (L x W x H)	
Front (panel view) L x W	124 x 124 mm
Back space (hidden)	146 x 143 x 72 mm
Weight	1. Kg

cat.no. 683180 100-230V ~50-60Hz CEE/CH/UK/US/AUS

The special advantages of the Vacuum Controller CVC 3000E:

- controls process vacuum, cooling water, and venting to demand
- analogue and digital pressure display: clear trend indication, easy to read, precise read out
- intuitive operation with turn-and-tap jog wheel and clear text menus, with integrated venting valve
- with an in-line solenoid vacuum valve mounted directly to the rear of the controller, with an integrated check valve included to avoid interference and contamination among neighboring work stations
- manual/semi-automatic determination of vacuum setting
- automatic setting of pressure intervals, manual override
- reduced foam formation due to fast valve response
- electronically selectable vacuum units (Torr, mbar, hPa)

More information is available in our 2008/2009 catalog, "Technology for Vacuum Systems," pp. 142 and at www.vacuubrand.com

BVC 01 BioChem-VacuuCenter Fluid Aspiration System

The BVC 01 BioChem-VacuuCenter is a helpful accessory on VACUU·LAN® networks and central vacuum systems where it is important to isolate aspirated biological material from the lab environment and avoid possible transfer to other workstations through a vacuum network.

The BVC 01 supports professional aspiration and disposal of liquids with high performance and easy handling for applications in biochemistry, biology, medicine and cell culture laboratories. Aspiration is managed with a control button on the ergonomic hand controller, the VacuuHandControl (VHC). A thumb-wheel allows convenient and precise microliter-volume aspiration and dispensing, avoiding turbulence in the sample. Thanks to automatic vacuum control, vacuum is provided automatically without need for a foot-switch at the pump. All aspirated liquids are collected in the autoclavable, shatter-proof collection bottle.

By connecting an additional VHC hand control, a second user can work with the BVC 01 economically and conveniently. The VacuuTransContainer (VTC) collection bottle is vacuum-controlled, and adjusted automatically via a valve. This reduces demand on the system, and protects other vacuum workstations from the interference that is common from aspiration applications.

For locations off a VACUU·LAN® network, and where central vacuum supply is not available, the BVC 21 NT and BVC 21 NT VARIO™ systems offer the capabilities of the BVC 01, but with an integrated vacuum pump.

BVC 01 BioChem-VacuuCenter Fluid Aspiration System
For aspirations of fluids in chemistry, biochemistry, cell biology and medical laboratories

- **VHC VacuuHandControl**
  Ergonomic aspiration hand set with adjustable tip holder, three adapters to accept a variety of common pipettes and tips, thumb speed control or permanent aspiration mode, built-in stand keeps tips off bench top. Supplied with 2 m tubing.

- **VTC VacuuTransContainer**
  4 l collection bottle, with second port to connect an optional second VacuuHandControl
  - autoclavable collection bottle with 0.2 µm sterile filter and self-locking quick-fit couplings
  - when used with vacuum networks or house vacuum, VTC collection bottle keeps liquids from vacuum lines
  - sterile 0.2 µm filter prevents infectious material from entering the vacuum network
  - minimal formation of aerosols in collection bottle extends filter lifetime

  Note: BVC 01 should not be used with chlorine bleach in the VTC. Vacuum applied to chlorine bleach creates chlorine gas, which is hazardous and corrosive to some components of the unit.

  Technical data:

dimensions (LxWxH):	300 x 250 x 500 mm
weight:	4 kg

  Items supplied: Completely mounted system with automatic vacuum controlled in-line valve, DN 10 mm hose nozzle for connection to a vacuum supply, VHC VacuuHandControl aspiration hand set, VTC VacuuTransContainer collection bottle, manual.

230V ~50-60Hz	cat.no. 688067 (CEE plug)
120V ~ 60 Hz	cat.no 688070 (US plug

More information is available in our 2008/2009 catalog, "Technology for Vacuum Systems," pp. 131 and at www.vacuubrand.com

6 Overview: VACUU·LAN® Adaptors and -Connectors

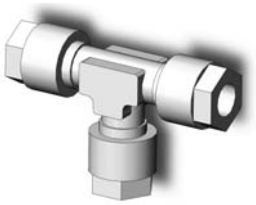
VCL-PTFE-Tube DN 10/8 mm

PTFE tubing, DN 10/8 mm for VACUU·LAN® systems, tempered for long life reliability outside diameter: 10 mm inside diameter: 8 mm cat.no. 638644	

VCL-Elbow Union DN 10/8 mm

VCL-Elbow Union (90°), with 2 DN 10/8 compression fittings for DN 10/8 mm PTFE-tube cat.no. 638434	

VCL-T-Union DN 10/8 mm

VCL-T-piece, with 3 DN 10/8 compression fittings for DN 10/8 mm PTFE-tube cat.no. 638435	

VCL-Straight Union DN 10/8 mm

VCL- Straight Union, with 2 DN 10/8 compression fittings for DN 10/8 mm PTFE-tube cat.no. 639990	

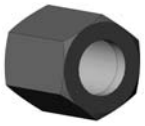
VCL-Adjustable Elbow DN 10/8 mm

VCL-Adjustable Elbow DN 10/8, with one DN 10/8 press-on tubing nozzle and one DN 10/8 mm compression fitting cat.no. 637873	

VCL-Straight Adaptor Union Thread G ¼"

Adaptor from G 1/4″ to DN 10/8 mm PTFE-tube with compression fitting. cat.no. 637221	

VCL-Nut M14

Nut M14x1, aluminum anodized, for elbow or straight VCL-fittings. cat.no. 639796	

VCL-Blank Plug, DN 10/8

Blank plug (PE) for uncontrolled DN 10/8 mm fitting ends. cat.no. 638501	

VCL-Adaptor KF DN 16

Adaptor from small flange KF DN 16 to PTFE–tube DN 10/8, without nut. cat.no. 637043 required Accessories: cat.no. 639796 (VCL-nut M14)	

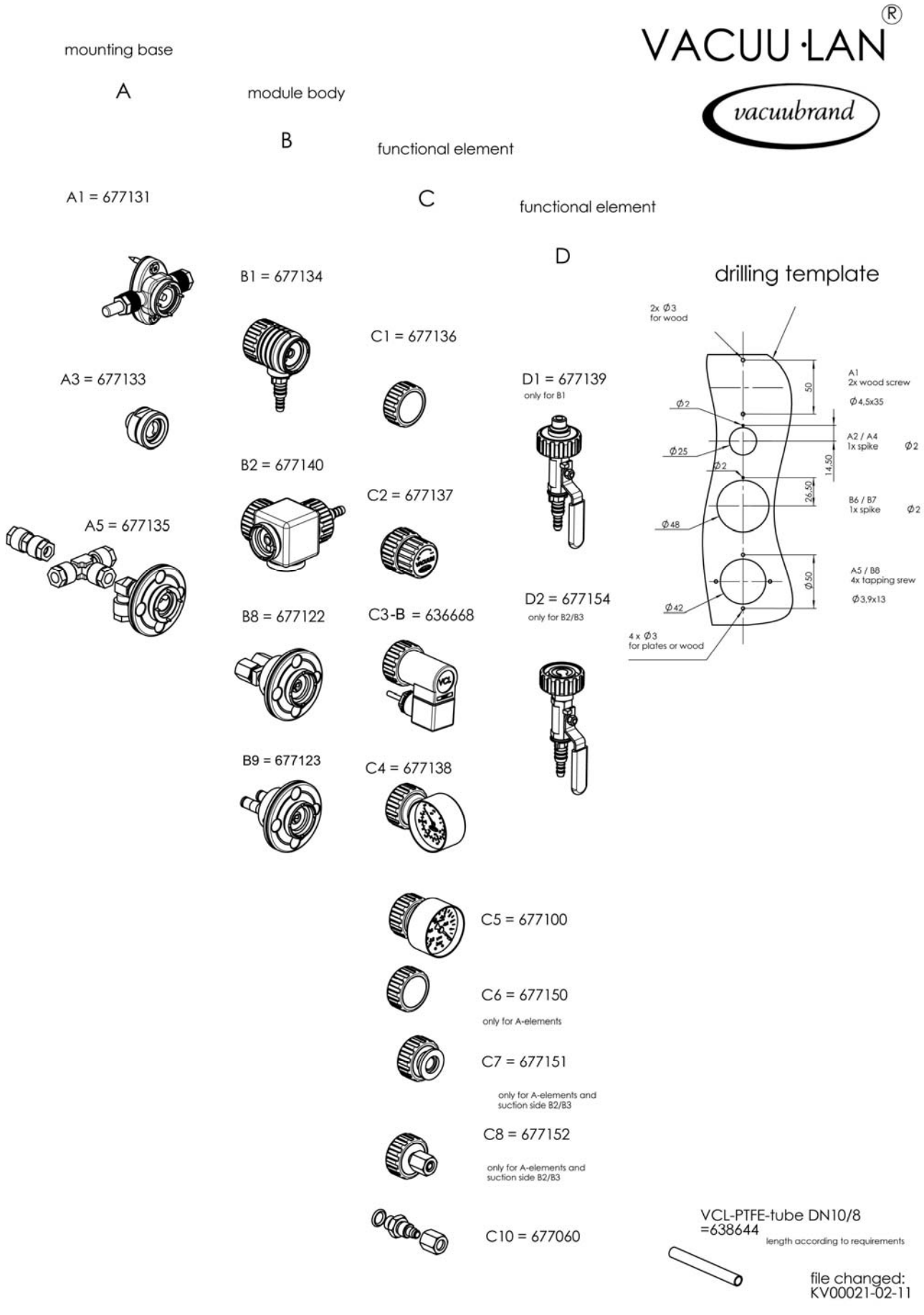
Clamping Ring for Small Flange

Clamping ring for small flanges. cat.no. 660000 (small flange DN 10/16, aluminum)	

Trapped O-Ring Centering Ring for Small Flange

Centering ring for small flanges. cat.no. 660190 (small flange DN 10/16, PBT / NBR)	

7 Overview: VACUU·LAN® Parts



7.1 A - Mounting bases

VACUU·LAN® - mounting base A1

Mounting base A1 is used for surface mounting of the vacuum network. E.g., for installing **VACUU·LAN®** into existing laboratories. Network tubing is visible and accessible.

mounting: two screws, 4.5 x 45 mm
network connection: 2 compression fitting connections for DN 10/8 mm PTFE-tube

cat.no. 677131

VACUU·LAN® - mounting base A3

Mounting base A3 is used for threaded connection sockets in wall or laboratory furniture.

mounting: screws into G 3/8" threaded connection socket in laboratory furniture or walls
network connection: G 3/8" external thread

cat.no. 677133

VACUU·LAN® - mounting base A5

With mounting base A5, vacuum lines can be integrated into lab furniture. Easy front mounting of mounting base, with tubing concealed behind wall or under bench top.

mounting: attached with 4 screws, 3.9 x 13 mm, onto walls or benches with unlimited wall thickness (only limited by elbow fitting up to 20 mm thickness)
For thicker penetrations, add straight union (cat.no. 639990)
network connection: **for** compression fitting for DN 10/8 mm PTFE-tube

cat.no. 677135

7.2 B - Module bodies

VACUU·LAN® - B1 module body

Module body with DN 6/10 mm hose nozzle and connection for functional elements C1, C2 or C3B. cat.no. 677134	

VACUU·LAN® - B2 module body

Cubic module body with DN 6/10 hose nozzle and two connections for different functional elements. The connections operate functional elements serially (e.g., for C2 flow control valve and C3B solenoid valve). cat.no. 677140	

VACUU·LAN® - B8 module body (for hoods)

The module body B8 has one connector for functional elements C2 or C3B. Mounting of B8 is outside the hood. It is used to attach a functional element for regulating a vacuum port that is inside the hood. Easy front mounting. mounting: wall mounting, wall thickness not limited fixed with 4 screws 3.9 x 13 mm network connection: compression connection for PTFE-tube DN 10/8 vacuum connection: compression connection for PTFE-tube DN 10/8 cat.no. 677122	

VACUU·LAN® - B9 module body (for hoods)

The module body B9 has one connector for functional elements C2 or C3B. Mounting of B9 is outside the hood. It is used to attach a functional element for regulating a vacuum port that is inside the hood. Easy front mounting. mounting: wall mounting, wall thickness not limited fixed with 4 screws, 3.9 x 13 mm network connection: connection for VCL elbow or straight adapters to connect PTFE-tube DN 10/8 mm, when space is cramped behind the panel vacuum connection: **for** compression fitting for DN 10/8 mm PTFE-tube cat.no. 677123	

7.3 C and D - Functional elements

VACUU·LAN® - functional element C1

Blind flange to close open connections of B module bodies. Best.Nr. 677136	

VACUU·LAN® - functional element C2

Manual flow control valve with PTFE-diaphragm and very good flow characteristics. Connectable to B module bodies. cat.no. 677137	

VACUU·LAN® - functional element C3B

Solenoid operated chemistry valve for automatic vacuum control in combination with a vacuum controller (e.g. CVC 3000 or VNC 2). VACUU·BUS™ equipped. housing material: PE (inside: PVDF) seat material: fluoroelastomer ambient temperature: max. 40°C gas temperature: max. 100°C no. of operations max. 50 min^{-1} elect. connection: VACUU·BUS™ cat.no. 636668	

VACUU·LAN® - functional element C4

Mechanical gauge (stainless steel housing) with 90° angled display. Connection to module body B2. cat.no. 677138	

VACUU·LAN® - functional element C5

Analog gauge (stainless steel housing). Connection to module body B. cat.no. 677100	

VACUU·LAN® - functional element C6

Blind flange to close open connections of A mounting base. Best.Nr. 677150	

VACUU·LAN® - functional element C7

Functional element for connecting vacuum lines to mounting bases A or to module body B2. Adapts vacuum lines with small flange DN 16 or with PTFE-tube DN 10/8 to the VACUU·LAN®. cat.no. 677151	

VACUU·LAN® - functional element C8

Functional element for connecting vacuum lines to mounting bases A or to module body B2. Fitting to vacuum lines with PTFE-tube DN 10/8. Especially for connecting standard (non-network) VAUUBRAND pumping units to a vacuum network (PTFE-tube DN 10/8). cat.no. 677152	

VACUU·LAN® - functional element D1 for module body B1

Manual shut off valve (stainless steel) for quick closing or opening of the vacuum line. Connection to module body B1. cat.no. 677139	

VACUU·LAN® - functional element D2 for module body B2

Manual shut off valve (stainless steel) for quick closing or opening of the vacuum line. Connection to module body B2. cat.no. 677154	

7.4 Overview VACUU·LAN® Modules

Description of Modules, with various mounting bases	Code* (abbreviation)	cat. no.	combination of base/body/functional element/ non-return valve (V)
mounting base A1			
manual flow control module	VCL 01 A1	67 71 06	A1/B1/C2/V
shut off-/manual flow control module	VCL 02 A1	67 71 07	A1/B1/C2/D1/V
automatic control module	VCL-B 10 A1	67 72 08	A1/B1/C3B/V
manual flow control-/automatic control module	VCL-B 11 A1	67 71 09	A1/B2/C2/C3B/V
shut off module	VCL K A1	67 71 55	A1/B1/C1/D1/V
manual flow control-/shut off-/gauge module	VCL RKM A1	67 71 75	A1/B2/C2/C4/D2/V
mounting base A3			
manual flow control module for hoods	VCL AR A3	On request	A3/B1/C1/V-B8/C2
automatic control module for hoods	VCL-B AE A3	On request	A3/B1/C1/V-B8/C3B-A3/C9-C10
mounting base A5			
manual flow control module	VCL 01 A5	67 71 90	A5/B1/C2/V
shut off-/manual flow control module	VCL 02 A5	67 71 91	A5/B1/C2/D1/V
automatic control module	VCL-B 10 A5	67 72 92	A5/B1/C3B/V
manual flow control-/automatic control module	VCL-B 11 A5	67 72 93	A5/B2/C2/C3B/V
shut off module	VCL K A5	67 71 94	A5/B1/C1/D1/V
manual flow control module for hoods	VCL AR A5	67 71 95	A5/B1/C1/V-B8/C2
automatic control module for hoods	VCL-B AE A5	67 72 96	A5/B1/C1/V-B8/C3B-A5/C9-C10
module for hoods	VCL A A5	67 71 67	A5/C9

*** Code Description:**

- 01 manual flow control module
- 02 shut-off & manual flow control module
- 10 automatic control module
- 11 automatic control module & manual flow control
- A module for hoods
- AE automatic control module for hoods
- AR manual flow control module for hoods
- K shut off module
- VCL-B B here is for VACUU·BUS™ (also C3B)

8 Checklists

When designing your VACUU·LAN® local vacuum network, consider the applications you intend to operated on the network to ensure that you select the vacuum pump and workstation modules that will best serve your needs. Remember that your VACUU·LAN® network is modular, so if changes are needed later to adapt to changing requirements, most workstation component substitutions can be made in a matter of minutes.

8.1 Checklist: Chemistry Pumping Unit

Vacuum and pump management specifications:

pumping speed – how many simultaneous users, and what type of applications?
ultimate vacuum – what kinds of applications?
continuous pump operation – for the most economical equipment; manual on/off
intermittent operation – auto on/off vacuum on demand, for lowest lifetime energy and maintenance costs

Connections:

connections/adaptors for vacuum network – what kind of control do you need at each workstation?

Other:
furniture integration – surface mounted or concealed tubing? pre-installation in hoods or casework?
dimensions – tubing needed? Distance of workstations from each VACUU·LAN® workstation
power supply – under benches or under hood for pump; extra outlet for Peltronic™ condenser, if chosen
water (coolant) installation – water supply and drain to each exhaust emission condenser location
chiller – as alternative to once-through water cooling; integrate cooling for evaporator with pump ondenser?
Peltronic™ condenser option – vapor capture without water; max. flexibility in labs with moveable casework
pump exhaust connection – link to fume hood exhaust lines

8.2 Checklist: Surface Mounting of the Vacuum Tubing

number of vacuum connections with ball valve only
number of vacuum connections with manual flow control only
number of vacuum connections with solenoid isolation valve
number of vacuum connections with ball valve and manual flow control
number of vacuum connections with solenoid isolation valve and manual flow control
number of vacuum connections with gauges
other…

8.3 Checklist: Integration of the Vacuum Tubing

mounting in bench/furniture:
type of mounting base
number of vacuum connections with ball valve only
number of vacuum connections with manual flow control only
number of vacuum connections with solenoid isolation valve
number of vacuum connections with ball valve and manual flow control
number of vacuum connections with solenoid isolation valve and manual flow control
number of vacuum connections with gauges
other…

mounting in hoods with separate vacuum ports inside/outside
mounting base for vacuum- resp. measuring port
number of vacuum connections with manual flow control in front panel (VCL AR)
number of vacuum connections with manual flow control in front panel and solenoid isolation valve (and Vacuum Controller) inside the hood (VCL AE)
number of vacuum connections with solenoid isolation valve / vacuum controllers with front panel and separate measuring ports
other ...

8.4 Checklist: Tubing

total length of PTFE tube
number of T-fittings
number of elbow fittings
number of straight fittings

9 Dimensional Drawings

Please feel free to contact us and request for our Handbook on Dimensional Drawings of VACUU·LAN® components.

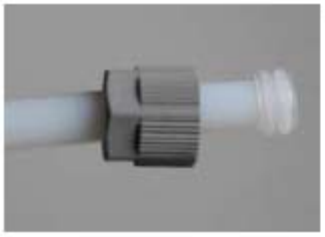
Making a VACUU·LAN® Tubing Connection

1. Assemble tools: tubing cutter, 17 mm open-end wrench, fittings and 10/8 mm PTFE VACUU•LAN tubing.

2. Use tubing cutter (not utility knife or razor blade) to cut tubing square and without burrs.

3. Loosen nut on fitting enough to accept tubing.

4. Insert tubing into loosened fitting



5. Remove nut and tubing from fitting. Confirm that sealing ferrule has been transferred from fitting to tubing.

6. Slide ferrule back from end of tubing about ½ inch (1 cm).

7. Insert tubing into fitting, ensuring that the tubing is firmly seated.

8. Keeping tubing firmly seated in fitting, use nut to push sealing ferrule back into fitting, and tighten nut finger-tight to properly seat the ferrule.

9. Use 17 mm open-end wrench to tighten nut on fitting one-half turn past finger tight. Do not over-tighten!

Note: Sealing ferrules are designed for single use. If you must open a tubing connection, replace the ferrule before restoring the connection to ensure a good seal.

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