



Full Line Catalog

Vacuum Components
and Vacuum Technology

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Leybold – Worldwide

Leybold – Pioneers of Vacuum Technology

In the mid-19th century, the company founder Ernst Leybold laid the foundation in Cologne for what would later become a global high-tech company. Already after a short time, he expanded the range of scientific equipment before selling his business in 1870. His life's work is today continued by Leybold following the proven tradition with a global sales and service network, high competence and expertise.

With over 1600 employees worldwide, the Leybold Group is a guarantor for the development, manufacture and sales of equipment and system solutions for the generation, control and measurement of vacuums. The range of products includes pumps, components and instruments, which are used in a variety of fields of application according to their specific design and the respective area of usage. The main application areas are metallurgy, automotive, coating applications, classic industrial processes, and production processes in the food-processing industry, but also highly technical applications in analysis, as

well as in research and development. Our capabilities include the development of components, standardized as well as application-specific and customer-specific systems for the creation of vacuums, and the management of process gases.

The extensive product portfolio is supplemented by our expertise and consulting know-how in the design and simulation of custom vacuum solutions. It is our aim to offer our customers tailor-made products and systems for their respective vacuum tasks.

In this sense, Leybold understands itself as a close partner of the respective user industries. Our qualified, motivated employees and our high innovative power are elementary factors for the constant development of our world-wide market leadership in our specific spheres of activity. This top position also ensures financial solidity and guarantees our customers around the world the best possible support in solving their particular challenges. Proximity to our customers is an important concern for us. That is why our worldwide service network, the

extensive after-sales services and the training programs of our Leybold Academy have continued to grow in the last few years and perfectly round off our portfolio.

For us, the quality of our products and services is a matter of course. A quality program that is specifically adapted to the structures of the company, and which also includes the entire delivery chain, ensures the continuous improvement of all business processes. The satisfaction and the success of our customers are the benchmark for all our quality efforts:

- Short delivery times,
 - a high degree of delivery punctuality,
 - and highest quality standards
- define our objectives and everything we do.

An important prerequisite is the certification according to DIN EN ISO 9001:2008.

Global Responsibility and Compliance

As a provider of advanced technology products and services, Leybold has established a unique position as a global leader. With our products, systems and services, we always create value for our customers. Furthermore, when it comes to efforts to tackle global challenges, we take on a pioneering role. Compliance is a great asset for us and an important guide for our corporate culture. For us, this

means that we adhere to the relevant laws, regulations and internal policies. In addition, it is our desire that in the pursuit of business activities we particularly live up to our ethical and legal responsibility. A stable set of values is the basis for our behavior towards all parties and for the maintenance of internal as well as external relations. This can be seen clearly both in the

interaction with all of our employees as well as with our customers all over the world. We attach great importance to long-term and stable relationships, characterized by respect at all times.



Quality Management System
DIN EN ISO 9001 : 2008



Authorized Economic Operator AEO



Customs-Trade Partnership Against
Terrorism C-TPAT

The Sales and Service Network

Think Global – Act Local

Our vision is to develop innovative industry solutions for better living conditions. That is why we want to be the world's leading provider of premium high-tech products and services in our industry.

On the basis of close, collaborative customer relationships, we are able to have a substantial effect on the productivity and the value of applications through our solutions. We achieve a high measure of customer satisfaction through market proximity, high reliability and the ability to implement the correct solutions rapidly.

In addition to our production sites in Europe and China, we count on our comprehensive worldwide sales and service network that is precisely tailored to the regional requirements in the respective markets. With our own sales companies, an international service, and representations in over 90 countries, Leybold has one of the largest sales and service networks in the vacuum industry.

With our presence on location, our competent consultation, comprehensive instruction and quick service, we have achieved a competitive advantage, which has been impressively confirmed by our business development over the last years.

Leybold has an area-wide presence in all regions that are relevant for the vacuum market, with its own companies, branch offices and service hubs.

In addition, an online shop provides the possibility of finding and immediately ordering vacuum pumps, spare parts and accessories. The simple order process and quick shipment of the articles also supports our customers' business processes.



Leybold GmbH, Cologne



Leybold (Tianjin), P.R. China



Leybold France S.A., Valence, France



Leybold Dresden GmbH



Leybold USA Inc., Export, Pa., USA

The ideal connection

Your current source of information
www.leybold.com

Vacuum Components

Vacuum Systems

Vacuum Service

Online Catalog

Documentation

Contact Data

Microsites

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Company Overview

As a pioneer of vacuum technology, Leybold offers a wide range of vacuum components, standardized and fully customized vacuum solutions, complemented by vacuum technology accessories and instrumentation.


Our core capabilities center on the development of application- and customer-specific systems for the creation of vacuums and extraction of processing gases.

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Research & Development

Extensive research & development often precedes great technological breakthroughs and advancements. Vacuum technology plays an important role in many research fields such as high energy physics, space research, surface & material sciences and many more.



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Leybold GmbH

Bonner Strasse 498 (Bayenthal)
50968 Cologne
Germany

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High Vacuum Pumps

The TURBOVAC turbomolecular vacuum pumps are used in applications which require a clean high or ultrahigh vacuum like, for example, in research, development or in industrial fields like the semiconductor industry, analytical instrumentation or coating technology.




TURBOVAC / TURBOVAC MAG High vacuum pumps with mechanical... More >	Oil-Diffusion Vacuum Pumps The pumping action of diffusion pumps... More >	Cryo Vacuum Pumps Cryo vacuum pumps are gas entrapment... More >
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Industrial Applications

Industrial applications clusters a large variety of modern production processes utilizing vacuum technology. The common denominator of such diverse applications such as steel degassing, heat treatment, drying equipment or leak testing machines is their use of pumps in challenging industrial type environments and the need to handle "more than just air", exactly what our industrial pumps are made for.



Leybold Services
Easy, competent, reliable

Leybold is available worldwide for you as a reliable and competent partner with its service network. We accompany your vacuum equipment over the entire life cycle with an innovative and comprehensive range of services.

Genuine Leybold Spare and Wear Parts Protect your vacuum equipment by using genuine Leybold spare and wear parts. More >	Leybold Field Service Our field service technicians are on-site to solve problems and find solutions... More >	Our Repair Centers Short repair times as well as quality standards characterize our repair centers. More >
Service Levels Our New Service Level Maintenance and repair tailored to your needs More >	Individual Preventive Maintenance Contracts With our preventive maintenance contracts you effectively protect your... More >	Rental and Backup Flexible usage, bridging periods, or exclusive backup... More >

For further information on a wide range of courses in vacuum technology please contact the Leybold Training Center in Cologne:

Leybold GmbH
Bonner Strasse 498
D-50968 Cologne
T: +49 221 347 1650
F: +49 221 347 31650

We would like to point out that also courses are given in the Leybold Training Center in Great Britain:

Leybold UK Ltd.
Unit 9
Silverglade Business Park
Leatherhead Road
Chessington
Surrey (London)
KT9 2QL
T: +44 1372 737300
F: +44 1372 737301

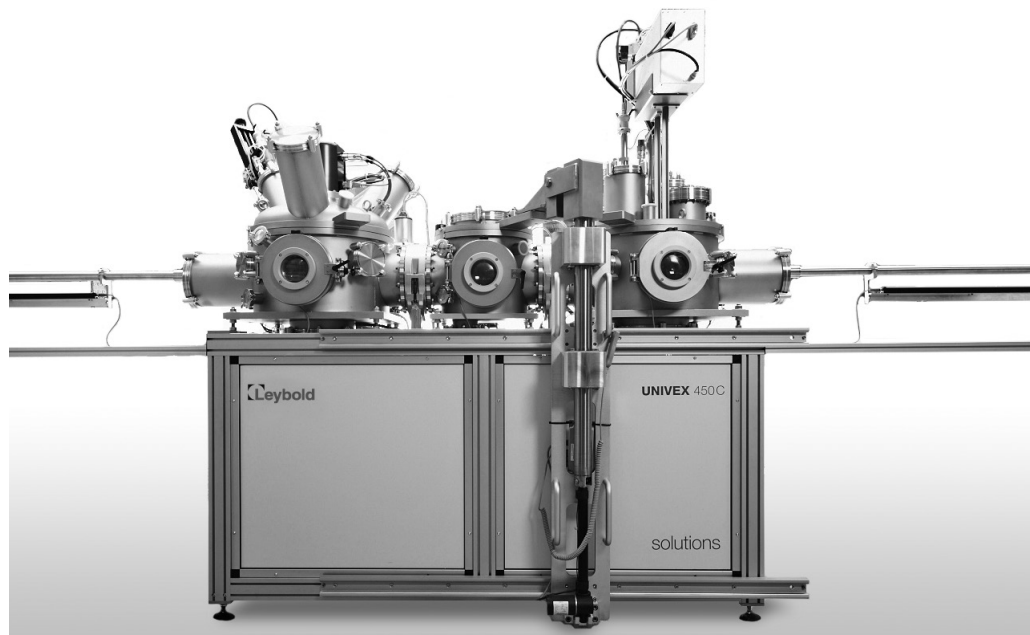
The latest information about our seminars including content and time schedule is available on the Internet: "www.Leybold.com".

Intelligent solutions begin with a good discussion...

We develop individual offers for the implementation of our technology in complete solutions in close cooperation with our customers.

This is where our range of services includes everything from customized bundling of individual products and services to entire value creation processes.

For this, we offer you the best solution for your technical vacuum tasks and accompany you throughout the entire process from engineering to after-sales service.



Special requirements require individual solutions

The quality of the selected vacuum system has a decisive influence on the function and efficiency of the application.

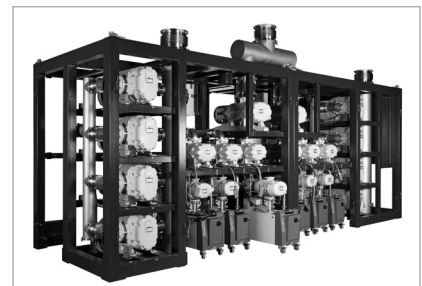
The space simulation chambers for the technical evaluation of materials for space shuttle flights and for the largest

mass spectrometer in the world are only two sample applications for which highest demands have to be fulfilled. Both show equally well that complex systems require assistance, design and technology at the highest level.

World-wide uniform quality standard

Owing to our global outlook, there will always be an expert at your side. Our tightly-knit network of customer service sites and workshops guarantees direct contact with our customers and also ensures a worldwide uniform standard of quality.

This applies to all our services. Because we know that service is a fundamental aspect for users who integrate our complex vacuum systems.



... and by no means stop there.

Individual system approaches require understanding and experience

With our comprehensive application experience, we can accompany you from A to Z to implement your product and process innovations. Experience is crucial, and covers everything from the exact understanding of the system requirements to the needs-based design of the after-sales support.

Based on our extensive project management and engineering expertise, we already support customers prior to the development and implementation of the system. Thanks to our copious know-how in

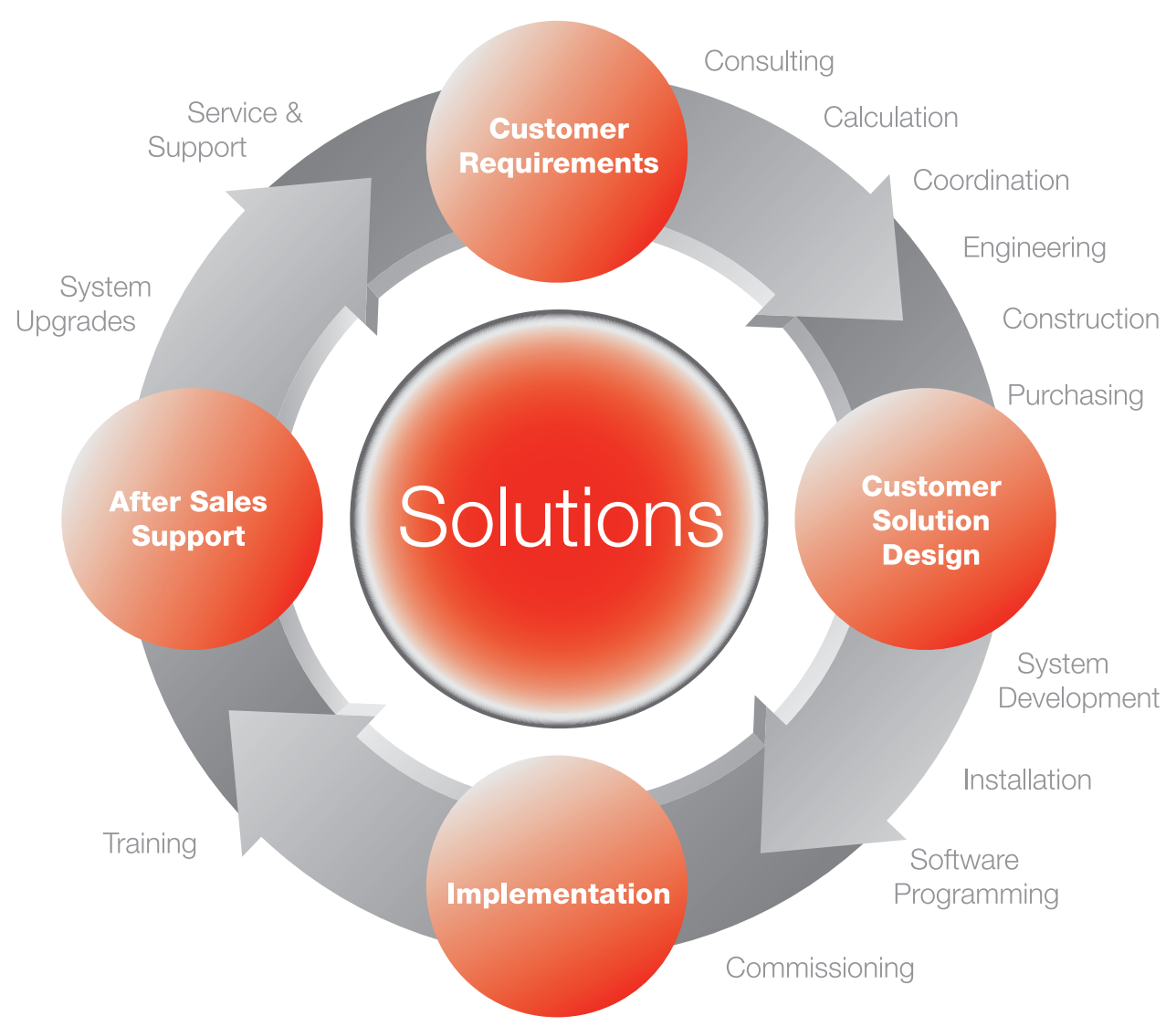
consultation, calculation, engineering and construction, we are able to identify and define accurately the customer's requirements for the system.

This process includes industry-specific, economic and technical aspects too, as they are the basis for the development of a future-proof vacuum system.

With our proprietary software PASCAL, we are able to simulate complex systems already in the planning phase of the application process and are thus ideally set up to provide an ideal system. This is where we make the cumulative expertise of our engineers available to our customers.

Leybold also has interesting solutions for experimental plants, whether standardized or adapted to the respective project:

- Universal systems for the production of function layers
- Modular system design, extensive range of accessories
- Individual system solutions according to customer specifications
- Variable chamber sizes
- Manual or fully automatic process control and plant control



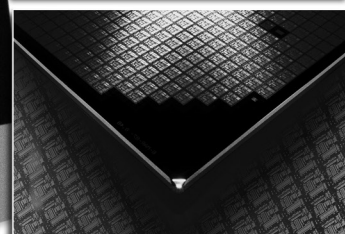
Areas of Application

Many things are possible with vacuum

The pleasure of beautiful things, the enjoyment provided by perfect sound quality, the demand for high load capacity and the requirements for ever more powerful products. These are only some of the many demands that can be satisfied only through the targeted use of vacuum technology - be it the finishing of surfaces, the coating of CDs, the manufacturing of heavy-duty components or the production of compact high-performance computers.

With vacuum technology by Leybold, goods and products that enrich our daily lives can be produced more precisely, more economically and much more sustainably. For instance, the titanium coating of watches, the anti-reflective coating on eyeglass lenses, or storage media with ever-increasing capacities. Hermetically sealed food packing, heavy-duty turbine blades, which make our airplanes more reliable and more economical, and flat screens too.

A vacuum that is intelligently produced and applied, is thus able to meet different requirements for the production of things that surround us in everyday life - for a sustainable, better future.





Members of the Leybold staff from sales, marketing, applications consulting and product development are in continuous contact with technology specialists. This guarantees that any application-specific requirements are considered in advance and can be incorporated at an early stage during product development.

Our customers are not buying just vacuum components – they are buying functional, application oriented products for individual solutions.

Products

	Applications																	
	Semiconductor production	Vacuum coating	Research and development	Loadlock and transfer chambers	Chemistry / Pharmaceutical	Metallurgy / Furnaces	Lamps and tubes manufacture	Automotive industry	Laser technology	Packaging	Space simulation	Analytical engineering	Environment engineering	Cooling and air-conditioning	Electrical engineering	Mechanical engineering	Paper / Printing	Solar energy
TRIVAC B and E Rotary vane vacuum pumps	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SOGEVAC Rotary vane vacuum pumps	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
VACUBE Screw Vacuum Pumps	■							■						■		■		
DIVAC Diaphragm vacuum pumps			■	■	■	■					■					■	■	
SCROLLVAC Scroll Vacuum pumps	■	■	■		■		■				■		■	■				
ECODRY plus Multistage roots vacuum pumps		■							■	■								
LEYVAC Dry compressing vacuum pumps	■	■	■	■	■	■		■	■		■		■	■	■		■	
SCREWLINE Dry compressing vacuum pumps	■	■	■	■	■	■		■	■		■		■	■	■		■	
DRYVAC Dry compressing vacuum pumps	■	■	■		■		■	■			■		■	■				
CLAWVAC Claw vacuum and overpressure pumps								■			■						■	
RUVAC Roots vacuum pumps	■	■	■		■	■	■	■	■	■	■		■	■	■	■	■	
Magnetically suspended turbomolecular pumps	■	■	■	■							■						■	
Mechanically suspended turbomolecular pumps	■	■	■	■		■	■				■						■	
DIP, DIJ, OB and LEYBOJET Oil diffusion pumps		■	■		■	■	■			■	■				■			
Refrigerator cryopumps	■	■	■	■	■	■			■	■							■	
RUTA vacuum pump systems	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
TURBOLAB High vacuum pump system		■	■		■	■				■	■			■	■			
UNIVEX high vacuum experimentation systems		■	■								■			■				
Total pressure gauges	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Leak detecting instruments	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Valves and flange components (ISO-KF, ISO-K, ISO-F, CF)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Ultra high vacuum pumps	■	■								■	■							

Sales and Service Net Worldwide

AMERICA

USA

Leybold USA Inc.
5700 Mellon Road
USA-Export, PA 15632
Phone: +1-724-327-5700
Telefax: +1-724-325-3577
info.ex@leybold.com

Sales:
Phone: +1-724-327-5700
Telefax: +1-724-333-1217

Service:
Phone: +1-724-327-5700
Telefax: +1-724-325-3577

Brazil

Leybold do Brasil Ltda.
Av. Tamboré, 937, Tamboré
Distrito Industrial
CEP 06460-000 Barueri - SP

Sales und Service:
T: +55 11 3376 4604
info.ju@leybold.com

Hotline

Sales: +49-221-347 1234
sales.vacuum@Leybold.com
service.vacuum@Leybold.com

EUROPE

Germany

Leybold GmbH
Sales, Service, Support Center (3SC)
Bonner Strasse 498
D-50968 Cologne
Phone: +49-(0)221-347 1234
Telefax: +49-(0)221-347 31234
sales@leybold.com
www.leybold.com

Leybold GmbH
Sales Area North
Branch office Berlin
Industriestraße 10b
D-12099 Berlin
Phone: +49-(0)30-435 609 0
Telefax: +49-(0)30-435 609 10
sales.bn@leybold.com

Leybold GmbH
Sales Area South
Branch office Munich
Karl-Hammerschmidt-Straße 34
D-85609 Aschheim-Dornach
Phone: +49-(0)89-357 33 9-10
Telefax: +49-(0)89-357 33 9-33
sales.mn@leybold.com
service.mn@leybold.com

Leybold Dresden GmbH
Service Competence Center
Zur Wetterwarte 50, Haus 304
D-01109 Dresden

Service:
Phone: +49-(0)351-88 55 00
Telefax: +49-(0)351-88 55 041
info.dr@leybold.com

The latest information is available on the internet
"www.leybold.com"

Belgium

Leybold Nederland B.V.
Belgisch bijkantoor
Leuvensesteenweg 542-9A
B-1930 Zaventem

Sales:
Phone: +32-2-711 00 83
Telefax: +32-2-720 83 38
sales.zv@leybold.com

Service:
Phone: +32-2-711 00 82
Telefax: +32-2-720 83 38
service.zv@leybold.com

France

Leybold France S.A.S.
Parc du Technopolis, Bâtiment Beta
3, Avenue du Canada
F-91940 Les Ulis cedex

Sales and Service:
Phone: +33-1-69 82 48 00
Telefax: +33-1-69 07 57 38
info.ctb@leybold.com
sales.ctb@leybold.com

Leybold France S.A.S.
Valence Factory
640, Rue A. Bergès
B.P. 107
F-26501 Bourg-lès-Valence Cedex
Phone: +33-4-75 82 33 00
Telefax: +33-4-75 82 92 69
marketing.vc@leybold.com

Great Britain

Leybold UK LTD.
Unit 9
Silverglade Business Park
Leatherhead Road
Chessington
Surrey (London)
KT9 2QL

Sales:
Phone: +44-13-7273 7300
Telefax: +44-13-7273 7301
sales.ln@leybold.com

Service:
Phone: +44-13-7273 7320
Telefax: +44-13-7273 7303
service.ln@leybold.com

EUROPE**Italy**

Leybold Italia S.r.l.
Via Filippo Brunelleschi 2
I-20093 Cologno Monzese

Sales:
Phone: +39-02-27 22 31
Telefax: +39-02-27 20 96 41
sales.mi@leybold.com

Service:
Phone: +39-02-27 22 31
Telefax: +39-02-27 22 32 17
service.mi@leybold.com

Netherlands

Leybold Nederland B.V.
Floridadreef 102
NL-3565 AM Utrecht

Sales and Service:
Phone: +31-(30) 242 63 30
Telefax: +31-(30) 242 63 31
sales.ut@leybold.com
service.ut@leybold.com

Switzerland

Leybold Schweiz AG
Hinterbergstrasse 56
CH-6312 Steinhausen
Lager- and Lieferanschrift:
Riedthofstrasse 214
CH-8105 Regensdorf

Sales:
Phone: +41-44-308 40 50
Telefax: +41-44-302 43 73
sales.zh@leybold.com

Service:
Phone: +41-44-308 40 62
Telefax: +41-44-308 40 60
service.zh@leybold.com

Spain

Leybold Hispánica, S.A.
C/. Huelva, 7
E-08940 Cornellá de Llobregat
(Barcelona)

Sales:
Phone: +34-93-666 43 11
Telefax: +34-93-666 43 70
sales.ba@leybold.com

Service:
Phone: +34-93-666 46 13
Telefax: +34-93-685 43 70
service.ba@leybold.com

ASIA**P.R. China**

**Leybold (Tianjin)
International Trade Co. Ltd.**
Beichen Economic
Development Area (BEDA),
No. 8 Western Shuangchen Road
Tianjin 300400
China

Sales and Service:
Phone: +86-400 038 8989
Phone: +86-800 818 0033
Telefax: +86-22-2697 4061
Telefax: +86-22-2697 2017
sales.tj@leybold.com
service.tj@leybold.com

India

Leybold India Pvt Ltd.
T-97/2, MIDC Bhosari
Pune-411 026
Indien

Sales and Service:
Phone: +91-80-2783 9925
Telefax: +91-80-2783 9926
sales.bgl@leybold.com
service.bgl@leybold.com

Japan

Leybold Japan Co., Ltd.
Headquarters
Shin-Yokohama A.K.Bldg., 4th floor
3-23-3, Shin-Yokohama
Kohoku-ku, Yokohama-shi
Kanagawa-ken 222-0033
Japan

Sales:
Phone: +81-45-471-3330
Telefax: +81-45-471-3323
sales.yh@leybold.com

Leybold Japan Co., Ltd.
Tsukuba Technical Service Center
1959, Kami-yokoba
Tsukuba-shi, Ibaraki-shi 305-0854
Japan

Service:
Phone: +81-29 839 5480
Telefax: +81-29 839 5485
service.iik@leybold.com

Malaysia

**Leybold Malaysia
Leybold Singapore Pte Ltd.**
No. 1 Jalan Hi-Tech 2/6
Kulim Hi-Tech Park
Kulim, Kedah Darul
Aman 09000
Malaysia

Sales and Service:
Phone: +604 4020 222
Telefax: +604 4020 221
sales.ku@leybold.com
service.ku@leybold.com

South Korea

Leybold Korea Ltd.
3F. Jellzone 2 Tower
Jeongja-dong 159-4
Bandang-gu Sungnam-si
Gyeonggi-do
Bandang 463-384, Korea

Sales:
Phone: +82-31 785 1367
Telefax: +82-31 785 1359
sales.bd@leybold.com

Service:
623-7, Upsung-Dong
Cheonan-Si
Chungcheongnam-Do
Korea 330-290
Phone: +82-41 589 3035
Telefax: +82-41 588 0166
service.cn@leybold.com

Singapore

Leybold Singapore Pte Ltd.
42 Loyang Drive
Loyang Industrial Estate
Singapore 508962
Singapore

Sales and Service:
Phone: +65-6303 7030
Telefax: +65-6773 0039
sales.sg@leybold.com
service.sg@leybold.com

Taiwan

Leybold Taiwan Ltd.
10F., No. 32, Chenggong 12th St.,
Zhubei City, Hsinchu County 302
Taiwan, R.O.C.

Sales and Service:
Phone: +886-3-500 1688
Telefax: +886-3-550 6523
sales.hc@leybold.com
service.hc@leybold.com

Symbols used in Vacuum Technology






















Vacuum Symbols

All symbols, except those marked ¹⁾ may be used in any orientation.

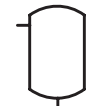
The symbols for vacuum pumps should always be so positioned that the narrowing lines point to the side of higher pressure.

¹⁾ These symbols must only be used in the indicated position (tip of the triangle pointing downwards)



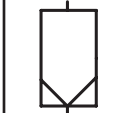
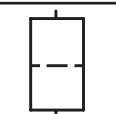





Vacuum Pumps

	Vacuum pump, general		Piston vacuum pump		Diaphragm vacuum pump
	Rotary positive displacement pump		Rotary piston vacuum pump		Sliding vane rotary vacuum pump
	Rotary plunger vacuum pump		Liquid ring vacuum pump		Roots vacuum pump
	Turbine vacuum pump, general		Turboradial vacuum pump		Turboaxial vacuum pump
	Turbomolecular pump		Ejector vacuum pump		Diffusion pump
	Adsorption pump		Getter pump		Sputter-ion pump
	Cryopump		Scroll vacuum pump		Screw vacuum pump



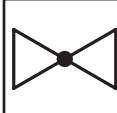
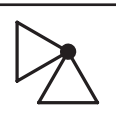
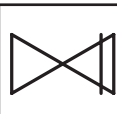
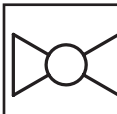
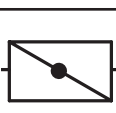

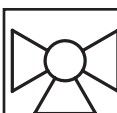
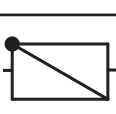
Container

	Vessel with crowned ends, general		Vacuum bell jar
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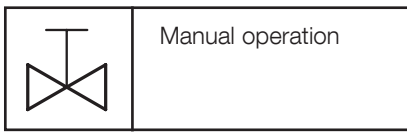
Accessories

	Separator, general		Separator with heat exchange, (e. g. cooled)		Gas filter, air filter, general
	Filter or filter device, general		Vapour baffle, general		Vapour baffle, cooled (with heat exchange)
	Cold trap, general		Cold trap with supply reservoir		Cold trap

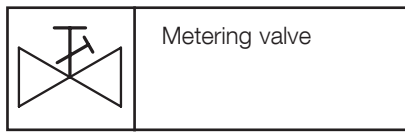
Isolating Devices

	Shut-off fitting, general		Gate valve		Shut-off valve, Straight-line valve
	Right-angle valve		Shut-off device with safety function		Stopcock
	Butterfly valve		Right-angle stopcock		Three-way stopcock
	Check valve				

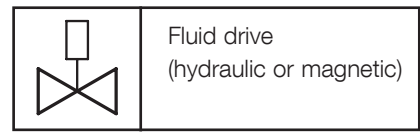
Valve Actuation



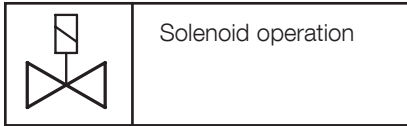
Manual operation



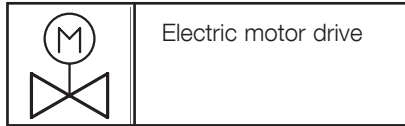
Metering valve



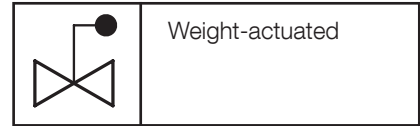
Fluid drive
(hydraulic or magnetic)



Solenoid operation



Electric motor drive



Weight-actuated

Connections and Piping



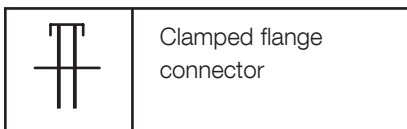
Flange connector,
general



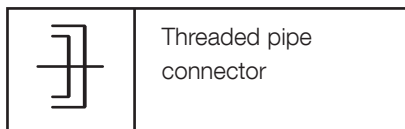
Flange connector,
bolted



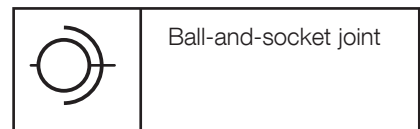
Small flange connector



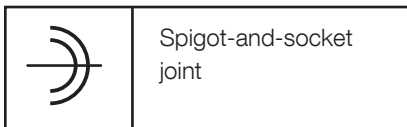
Clamped flange
connector



Threaded pipe
connector



Ball-and-socket joint



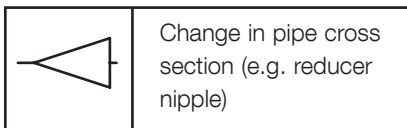
Spigot-and-socket
joint



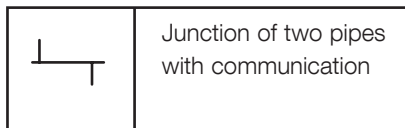
Connection by taper
ground joint



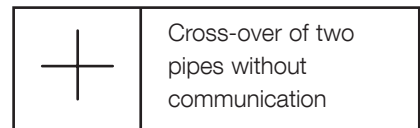
Flange connector,
general



Change in pipe cross
section (e.g. reducer
nipple)



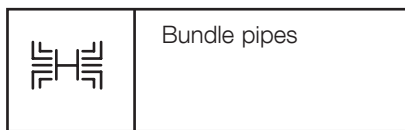
Junction of two pipes
with communication



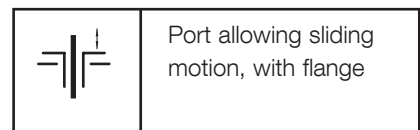
Cross-over of two
pipes without
communication



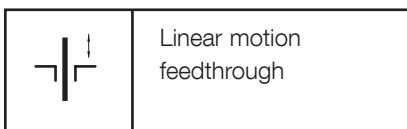
Branch point



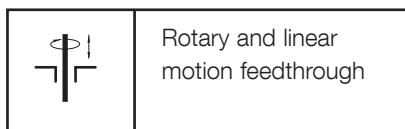
Bundle pipes



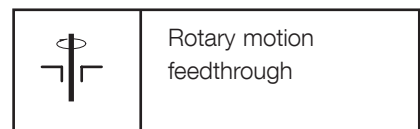
Port allowing sliding
motion, with flange



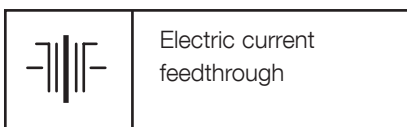
Linear motion
feedthrough



Rotary and linear
motion feedthrough










Rotary motion
feedthrough



Electric current
feedthrough

Vacuum Measurement and Gauges

	1) Vacuum (to indicate the presence of a vacuum)		1) Vacuum measurement, Vacuum measurement point		1) Vacuum gauge
	1) Recording vacuum gauge (writing)		1) Vacuum gauge with analogue display		1) Vacuum gauge with digital display
	Flow measurement				

1) These symbols must only be used in the indicated position (tip of the triangle pointing downwards)

Pressure Units

	bar	mbar (hPa)	Pa	atm	Torr	mTorr
1 bar	1	10 ³	10 ⁵	0.987	0.750 x 10 ³	0.750 x 10 ⁶
1 mbar (hPa)	10 ⁻³	1	10 ²	0.987 x 10 ⁻³	0.750	0.750 x 10 ³
1 Pa ¹⁾ (N · m ⁻²)	10 ⁻⁵	10 ⁻²	1	0.987 x 10 ⁻⁵	0.750 x 10 ⁻²	0.750 x 10 ¹
1 atm = 760 Torr	1.01	1.01 x 10 ³	1.01 x 10 ⁵	1	0.760 x 10 ³	0.760 x 10 ⁶
1 Torr	1.33 x 10 ⁻³	1.33	1.33 x 10 ²	1.32 x 10 ⁻³	1	10 ³
1 mTorr	1.33 x 10 ⁻⁶	1.33 x 10 ⁻³	1.33 x 10 ⁻¹	1.32 x 10 ⁻⁶	10 ⁻³	1

1) Pa = Pascal, hPa (Hectopascal) whereat 1 hPa = 1 mbar
The mbar is widely used in research, particularly in the vacuum technology.

All dimensions given in the technical drawings are stated in mm.

Dimensions in () are stated in inch.

The products of Leybold are subject to continual further development; thus the technical data or the dimensional drawings are subject to change without prior notice.

On the basis of international agreements (ISO/R 1000) and the regulations which apply in the Federal Republic of Germany based on these (laws on the units used in metrology) as well as the Vacuum Engineering Standards (DIN 28 400 and subsequent numbers) we have adapted the characteristic quantities stated in this catalog to the current regulations.

The table gives the conversion factors between commonly used pressure units.

$$1 \text{ mbar} \times l \times s^{-1} = 60 \text{ sccm}$$

Pressure Units

Conversion Factors

1 inch	2.54 cm
1 ft	30.48 cm
1 sq inch	6.45 cm ²
1 sqft	0.0929 m ²
1 cu inch	923.03 cm ³
1 cu ft	28.32 liter
1 US gallon	3.78 liter
1 Imp gallon	4.54 liter
1 micron	1.33 x 10 ⁻³ mbar
1 US qt	0.946 liter
1 Imp qt	1.137 liter
1 lb	0.453 kg
1 hp	735 W
1 r.p.m.	1 min ⁻¹

Temperature

°C	°F
0	32
10	50
20	68
30	86
40	104
50	122
60	140
70	158
80	176
90	194
100	212

$$^{\circ}\text{F} = 1.8 \times ^{\circ}\text{C} + 32$$

Pressure

psi	bar
1.0	0.07
10	0.70
14.5	1.00
20	1.38
30	2.07
40	2.76
50	3.45
60	4.14
70	4.83
80	5.51
90	6.20
100	6.90

Various pressure units

mbar (millibar)	Torr	inches Hg vacuum
1013	760	0
400	300	18.12
133	100	25.98
4	3	29.80
1	0.75	29.89
0	0	29.92

Various pumping speed units

	m ³ x h ⁻¹	l x s ⁻¹	cfm
m ³ x h ⁻¹ = m ³ /h	1.0	0.278	0.589
l x s ⁻¹ = l/s	3.60	1.0	2.12
cfm (cubic feet per minute)	1.699	0.472	1.0

Example: 1 m³ x h⁻¹ = 0.589 cfm

Please note: The nominal pumping speed of a pump at 60 Hz is 20% higher than at 50 Hz

Dimensions

Inches	Inches	mm
1/8	0.1250	3.1750
1/4	0.2500	6.3500
3/8	0.3750	9.5250
1/2	0.5000	12.7000
3/4	0.7500	19.0500
1/1	1.0000	25.4000

Various flow rate units

	mbar x l x s ⁻¹	kg x h ⁻¹	cm ³ x s ⁻¹	slm
mbar x l x s ⁻¹	1.0	4.28 x 10 ⁻³	0.987	59.2 x 10 ⁻³
kg x h ⁻¹ (0 °C)	218	1.0	215	12.91
cm ³ x s ⁻¹ (NTP)	2.81 x 10 ⁻⁴	1.2 x 10 ⁻⁶	1.0	1.66 x 10 ⁻⁵
slm (standard liter per minute)	16.88	72.15 x 10 ⁻³	16.67	1.0

The booklet “Fundamentals of Vacuum Technology” covers on 234 pages in an easily comprehensible and clear manner all relevant aspects of vacuum technology.

Through 16 chapters the reader learns about all important aspects of handling “vacuum”.

Besides the fundamentals of vacuum physics, the field of vacuum technology beginning with vacuum generation, vacuum measurement and ending with leak detection and vacuum coating processes is described in detail.

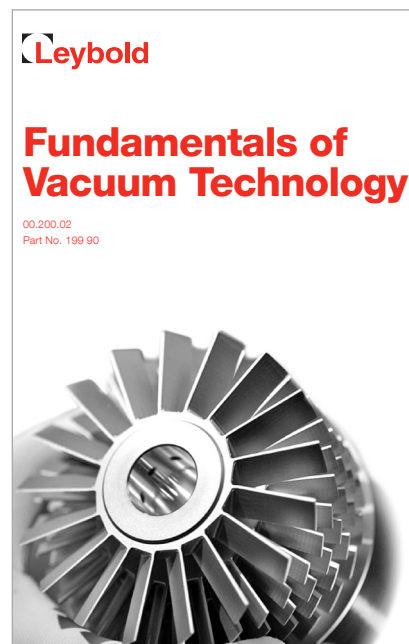
The compilation explains the different pumping principles employed for generating a vacuum, assists in the selection of a suitable pumping process, dimensioning of the necessary pump size as well as designing a vacuum system.

A separate chapter deals with the measurement of low pressures, pressure monitoring, pressure regulation and control.

Further fields of vacuum technology like mass spectrometric gas analysis at low pressures, leak detection or vacuum engineering applications like coating processes and film thickness measurements are described too. Also recommended and indispensable are the numerous practice related operating hints for vacuum systems.

This booklet is of interest to beginners and vacuum experts alike.

Numerous tables, formulae and diagrams, as well as the explanation of vacuum engineering standards, supplement the material for a deeper understanding of all vacuum technology aspects.



Ordering Information

Fundamentals of Vacuum Technology

	Part No.
Fundamentals of Vacuum Technology	199 90

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