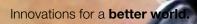
Ophthalmic optics.

- Anti-reflection (AR) coatings
- Fashion mirror coatings
- Photochromic coatings
- Hard coatings
- Rx & stock lens coatings
- Sun glass coatings
- Sports glass coatings





Ophthalmic optics solutions by Bühler. Latest anti-reflection technology and beyond.

As one of the world leaders in thin-film technology, we develop and manufacture vacuum deposition equipment for a broad range of applications. The foundation for our firm's present-day success was laid by inventors Ernst Leybold and Wilhelm Carl Heraeus 160 years ago. Today, Bühler Leybold Optics is a globally active high-tech company, with the business area's headquarters in Alzenau (Germany) and subsidiaries in Cary (USA) and Beijing (China). Worldwide, we employ over 300 employees. Since 2012, Leybold Optics has been part of the Bühler Group. Headquartered in Switzerland, Bühler is one of the world's leading suppliers of industrial equipment with a presence in over 140 countries. A top priority for us is innovation leadership.

Perfect design and impeccable function – made possible with Bühler Leybold Optics solutions.

For decades, we have been at the forefront of ophthalmic coating technology development. Today, we offer the most comprehensive and competitive portfolio of anti-reflection batch coating systems on the market. We shaped the ophthalmic industry with a series of break-though innovations, starting with the first anti-reflective eyeglass coatings in the 1950s.

Since then, numerous milestones have been achieved:

- 1960's Introduction of bell-jar systems, enabling the first industrial ophthalmic optics applications
 1970's First successful anti-reflective and scratch-protection coatings on CR-39 lenses
- **1980's** Introduction of plasma-assisted deposition processes
- 2000's Turnkey laboratory solutions with MINI LAB and EASY LAB
- 2003 Antistatic- and superhydrophobic coatings
- 2009 Latest-generation proprietary ion-source LION
- Since Bühler Leybold Optics displays by far the most ample systems portfolioand process library in the ophthalmic optics industry
- **2014** Introduction of BOXER 900, dedicated to mid- to high-volume production
- 2015 First drum-coater type LEYBOLD OPTICS MIR
- 2016 Introduction of LEYBOLD OPTICS ECS
- 2018 Photochromic coating with UMBRA 60 system

As Bühler Leybold Optics we center our efforts on ensuring customers' success!



With over 160 years' experience, Bühler Leybold Optics is a leading supplier of vacuum thin-film coating technology. Our state-of-the art solutions include: precision; ophthalmic and automotive optics applications, architectural and automotive glass for a wide range of energy saving applications, and roll-toroll plastic film coatings for packaging, electronic and safety applications. All of our solutions are tailored for our customers' specific market demands.

We are continuously improving our core-component technology and know-how to offer 1st class coating solutions, process expertise and customer services. Presently digitalization of our products offering best solutions, as well as digitization our company to continue offering the best solutions and serving our customers most efficiently.

From anti-reflection coatings to complex interference filters, we support in the development of new products with optics technology. Every year we invest a significant amount on research and development to improve further our technology concerning quality, precision, sustainability, serviceability and the ecological footprint of our processes and machines. We like to welcome you in our state-of-the-art Application Center where you can test samples and processes to find the most suitable solution for your needs together with our experts.

We strive to maintain our benchmark position and to be an innovative and reliable partner for our customers.

I am looking forward to work together with you!

Sincerely yours,

Antonio Requena Managing director Bühler Alzenau GmbH Business Area Leybold Optics











Leybold Optics – production portfolio overview. Smart solutions for Rx and stock lenses.





LEYBOLD OPTICS CCS series

The LEYBOLD OPTICS CCS series is a unique concept, especially optimized for the needs of small to medium Rx laboratories. Its modular philosophy allows to start with a low initial investment. As business demand grows, a wide range of upgrades are available to match.

Productivity 50-200 pairs / 8h

Page 10

BOXER 900

The BOXER 900 is a highly flexible, mid-size to high-volume platform for Rx and stock lens production. It excels with intelligent, robust design and a compact footprint.

Productivity 270-460 pairs / 8h

Page 12





SYRUS 1100

Known in the market as the undisputed workhorse for highvolume 24/7 production, this machine is setting benchmarks due to its highly productive, reliable and cost-efficient setup, thus making SYRUS the ideal choice whenever large batches are feasible.

Productivity 360-600 pairs / 8h

Page 14

LEYBOLD OPTICS ECS 1350

This coater is extremely focused on low-cost mass production. In this segment, its throughput per CAPEX ratio is the industry benchmark for stock lens production, but also suitable for Rx manufacturing.

Productivity 550-890 pairs / 8h

Page 16



The drum coating system LEYBOLD OPTICS MIR 1200 is designed for production of curved lenses as well as the combination of gradient coating and full lens area coating.

Page 18



LEYBOLD OPTICS HCS series

The cleaning and dip-coating series LEYBOLD OPTICS HCS is available in three different sizes. Every single one delivers a perfect hard coating performance which is second to none.

Productivity 80-800 pairs / 8h

Page 22



UMBRA 60

The all-in-one solution for having cleaning, hard coating and photochromic coating in one system which enables fastest fadeback of any commercially available lens.

Productivity 200-240 pairs / 8h

Page 23

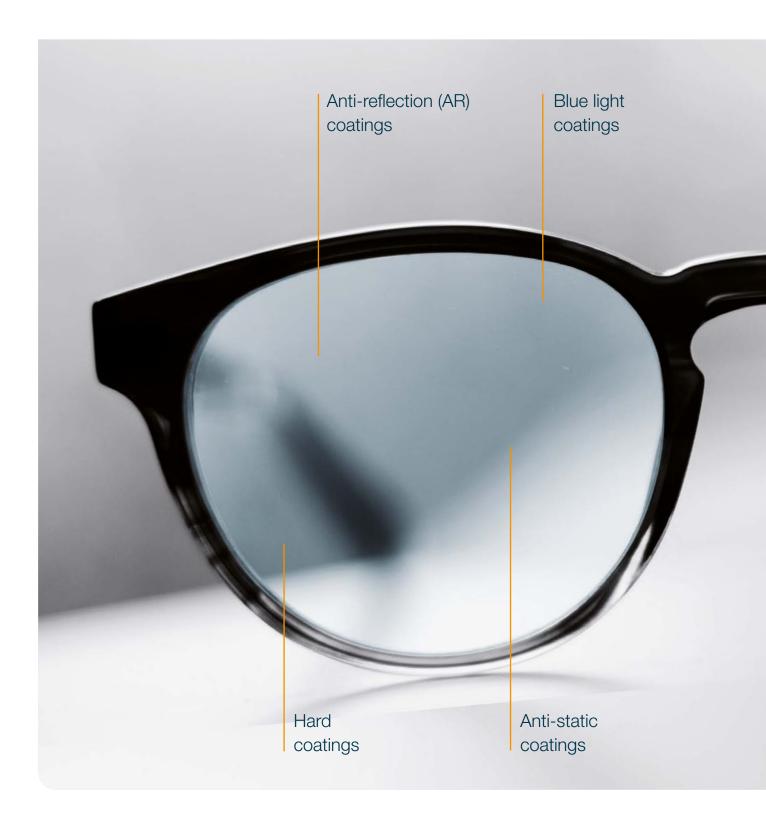


Ophthalmic optics lab

Bühler Leybold Optics offers complete turnkey, tailored solutions for building up complete ophthalmic optics labs. Based on our broad machine portfolio and own process know-how, we are the partner of choice when entering the ophthalmic optics market.

Page 24

Leybold Optics – advanced coating technology. **More efficiency, reliability and flexibility.**





LEYBOLD OPTICS CCS series. (50 – 200 pairs / 8 h) **The unique modular coating platform.**

Besides excellent AR processes, the LEYBOLD OPTICS CCS' unique modular concept enables you to start with a moderate initial investment, but without compromising on quality. With our carefully designed upgrade packages, the machine can grow along with your business – turning the system into a powerful and versatile tool for a mid-size laboratory.



Key benefits:

- One chamber size of 610 mm
- Unique concept for small to medium Rx laboratories
- Ergonomic top-loader design

- With flip-over system or full-dome
- Cylindrical chamber for quickest shield removal/ cleaning





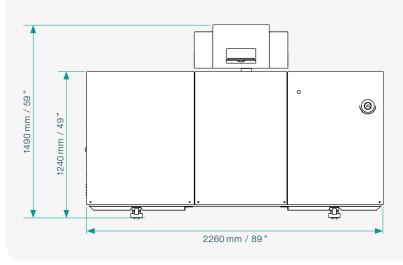
Automatic flip-over lens carrier

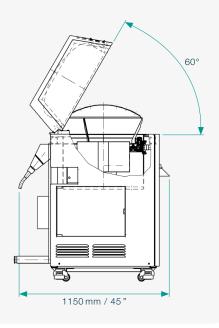
Full-dome for increase in loading capacity

Technical data

		LEYBOLD OPTICS CCS 610	LEYBOLD OPTICS CCS 610+
Substrate holder		Flip-over	Full-dome
Loading capacity	Ø 65 mm	24	52
[pcs.]	Ø 70 mm	16	48
	Ø 75 mm	16	42
	Ø 80 mm	16	32
Process time	Single-side coated		35 min
	Both sides coated	50–55 min	70 min
Productivity Ø	Single-side coated	144 pairs	288 pairs
70 mm / 8 h	Both sides coated	72 pairs	144 pairs
Components	Electron-beam gun	LEYBOLD OPTICS HPE 6	LEYBOLD OPTICS HPE 6
	lon source	Mark I+	Mark I+
	Pre-vacuum pump	RA 100	RA 100
	Turbomolecular pump	HiPace 1500	HiPace 1500
	Cryogenic refrigerator	optional	included
	Thermal evaporator		optional

LEYBOLD OPTICS CCS 610





BOXER 900. (270-460 pairs/8h) For versatile mid- to high-volume production.

Uncompromising performance combined with an ingenious, compact design: This is BOXER 900. Its design facilitates easy and quick handling and maintenance.



Dual-quartz-crystal sensor system for maximum process safety

Bühler Leybold Optics ion-source control and power supply

LEYBOLD OPTICS HPE series electron-beam gun with multi-pocket crucibles

Maximized cold-trap surface area to optimize pumping of water vapor

Optimized distribution-masks system for highest rates and uniformity

Highly-flexible solution for Rx and stocklens production

From classic broadband anti-reflection coating to mirror coatings – a great number of different processes can be carried out with BOXER 900.

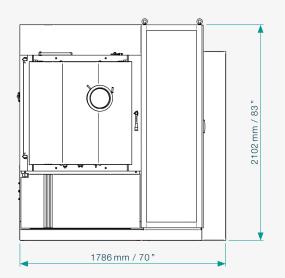
Key benefits:

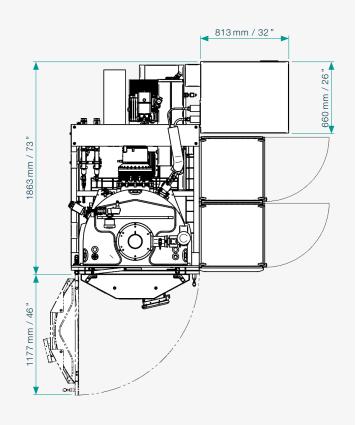
- Mid- to high-volume Rx and stock lens production
- Best access for easiest batch exchange
- Calotte segmented into 3 light-weight parts
- Quick removal of protection shields for cleaning
- Very fast pumping down to process pressure
- Economic pumping stack arrangement

Technical data

		BOXER 900
Substrate holder		3-segment calotte
Loading capacity [pcs.]	Ø 65 mm	114
	Ø 70 mm	96
	Ø 75 mm	81
	Ø 80 mm	72
Process time	Single-side coated	30 min
	Both sides coated	65 min
Productivity Ø 70 mm / 8 h	Single-side coated	768 pairs
	Both sides coated	384 pairs
Dimensions	Chamber diameter	900 mm / 35.4"
	Footprint	3.3 m² / 36 sq. ft.
Components	Electron-beam gun	LEYBOLD OPTICS HPE 12/10
	Pre-vacuum pump	2 x RA-100
	Turbomolecular pump	HiPace 2300
	lon source	Mark II+
	Thermal evaporator	Optional

BOXER 900





SYRUS 1100. (360–600 pairs/8h) The benchmark in the eyeglass industry.

Known in the market as the undisputed workhorse for high-volume 24/7 production, this machine is setting bench marks due to its highly productive, reliable and cost-efficient setup, thus making SYRUS the ideal choice whenever large batches are feasible.



SYRUS 1100 – the bridging coating machine between stock and Rx lens production

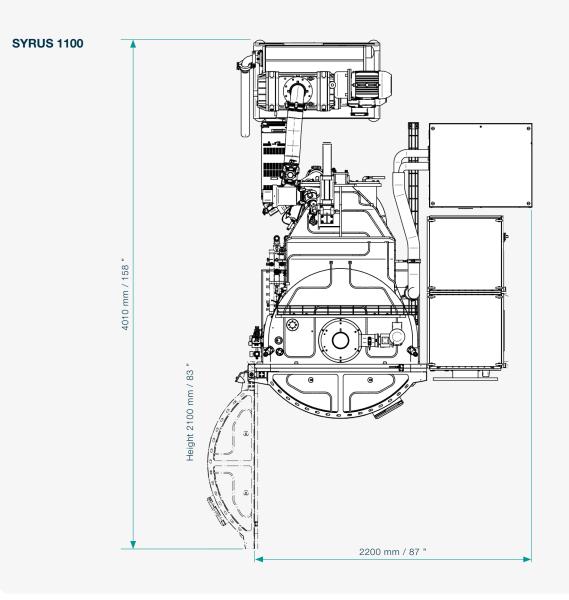
Due to the largest variety of configurations the SYRUS 1100 can be perfectly matched to customer's individual needs. In such this coating tool is ideal for stock lens manufacturing with increasing numbers of Rx products as well for highly specialized applications.

Key benefits:

- Ideal for high-volume stock lens production
- Broadest variety of configurations
- In-chamber (super)hydrophobic coatings

Technical data

	4-segment calotte	SYRUS 1100
Loading capacity	Ø 65 mm	168
[pcs.]	Ø 70 mm	144
	Ø 75 mm	128
	Ø 80 mm	108
Process time	Single-sided	35 min
Dimensions	Chamber diameter	1100 mm / 43.3"
Components	Electron-beam gun	LEYBOLD OPTICS HPE 6
	Pre-vacuum pump	300 m³/h
	Roots pump	1000 m³/h
	Diffusion pump	12000 l/s
	lon source	Mark II+
	Cryogenic refrigerator	included



LEYBOLD OPTICS ECS 1350. (550–890 pairs / 8h) **High performance, cost-effective production.**

The LEYBOLD OPTICS ECS 1350 is Bühler Leybold Optics' offering for massproduction of eyeglass coatings where optimum value from investment ist an undermost requirement.



Key benefits:

- For mid- to high-volume stock lens production
- Optimum CAPEx performance ratio
- Proprietary Bühler Leybold Optics processes available

LEYBOLD OPTICS ECS 1350 -

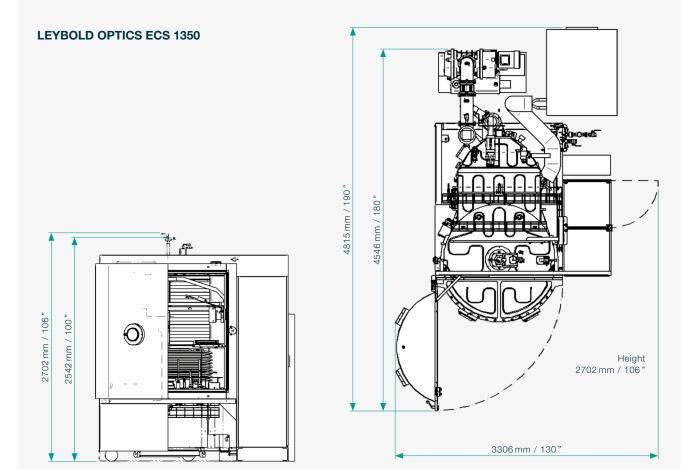
highest througpput and unbeatable cost-per-lens

Designed for large batches, both for classical stock lens mass-production and for Rx production, this coating tool excels with unsurpassed cost-benefit ratios.

Technical data

		Leybold Optics ECS 1350			
Loading capacity [pcs.]	Ø 65 mm	293			
	Ø 70 mm	252			
	Ø 75 mm	223			
	Ø 80 mm	195			
Process time	Single-sided	28 min			
Components	Electron-beam gun	LEYBOLD OPTICS HPE 12/10*			
	lon source	Mark II+			
	Pre-vacuum pump	300 m ³ /h			
	Roots blower	1250 m ³ /h			
	Diffusion pump	22000 l/s			

(*) Other configurations available



LEYBOLD OPTICS MIR 1200. Ideal for mirror coatings on curved substrates.

LEYBOLD OPTICS MIR 1200 is designed for production of curved lenses as well as the combination of gradient coating and full lens area coating. Typical coating materials are SiO_2 and TiO_2 to produce interference mirrors.



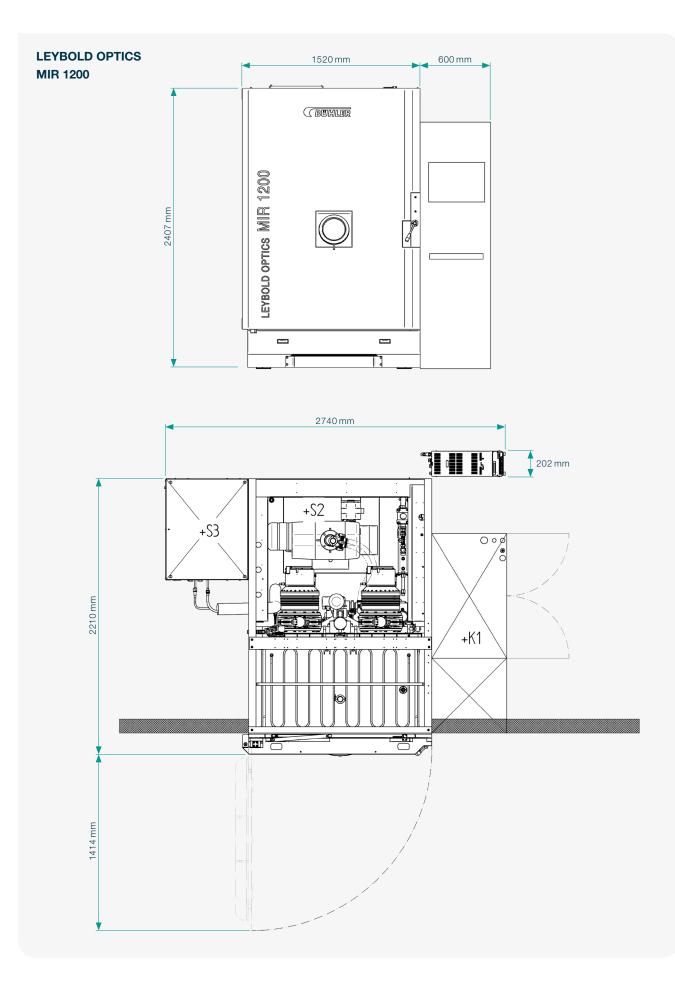
Key benefits:

- Fast loading and unloading of the complete drum
- High loading capacity
- Variety of substrates: suitable of flat and curved substrates

LEYBOLD OPTICS MIR 1200 -

the drum coating solution for outstanding products

It is the perfect solution to produce sun lenses, sport glasses, ski googles, helmed visors or helmed HUD with absorbing layers in different colors, dielectric layers, mirror coatings, gradient coatings and AR coatings.



Leybold Optics - components. Assured productivity through high quality.





Pre-vacuum systems



Media supplies

Chamber width

Refrigeration systems



High-vacuum systems



Meissner traps



Vacuum measuring



Substrate handling

Standard Option						Pre-vac systems		High-va system		Vacu	um n	neasui	ring	Med	lia sup	oplies			Refr syst	igerat ems	ion	
	610 mm	900 mm	1100 mm	1200 mm	1350 mm	Rotary vane pump	Vane pump and roots blower	Diffusion pump	Turbomolecular pump	Pirani	Penning	Bayard-Alpert	RGA	CDA	Water cold	Water warm	Gases	Electricity	Megatec	Polycold / Maxcool	Telemark	
CCS																						
BOXER																						
SYRUS																						
ECS																						
MIR																						





Electron-beam guns



Thermal evaporators



Thickness measuring

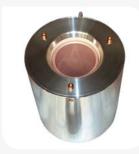


Other ion sources

Heating systems



Lion ion sources



APS ion sources



Beckhoff Automatio

PC systems

Meissner Substrate Heating Electron-beam Thickness Other ion Lion ion APS ion PC Thermal trap handling systems guns evaporators measuring sources sources sources systems Segmented dome Process support PC with SSD and UPS Double quartz Single quartz 6-fold quartz Shield type HPE 12/10 Single boat Tube type Degassing Full dome LION 100 Flip-over HPE 12 Top coat Mark II+ APSpro Mark I+ HPE 6 Drum

LEYBOLD OPTICS HCS. (80–800 pairs / 8h) **Dip-cleaning and hard coating systems.**



These high-quality systems removes any kind of organic, chemical or mineral residue from the lens surface before starting the hard coating process and AR treatment application. The systems can be tailored to your volume needs and investment level.

System	LEYBOLD OPTICS HCS 20	LEYBOLD OPTICS HCS 60	LEYBOLD OPTICS HCS 200
Dimensions L D H	1720 mm 1000 mm 2000 mm	2800 mm incl. conveyors 1000 mm 2000 mm	4000–5000 mm incl. conveyors 1150 mm 2000 mm
Batch Size	1 pair	3 pairs	8 pairs
Process Time *depends on process	80-100 / 8h	200–280 / 8h	600-800 / 8h
Throughput	20-25 lenses/hour	50-70 lenses/hour	150-200 lenses/hour
Conveyor load	No	Yes	Yes
Options	Fully integrated inspection booth	 Fully integrated inspection booth Photochromic update Additional coating tank Swappable tanks 	 Fully integrated inspection booth Photochromic update Additional cleaning/coating tanks Swappable tanks

Special features:

- Conveyor infeed and outfeed allow up to unattended machine operation for up to 30 minutes.
- Available with upgrade-option to photochromic.
- Suitable for any substrate due to 3 coating tanks.
 1 x primer tank, 2 x index matched hardcoating tanks
- Configurable dip processes: Single vision/Bifocal/Trifocal

Key benefits:

- Fully automatic cleaning and hardcoating
- Top quality construction minimum downtime
- Small footprint
- Full range of chemicals and accessories

UMBRA 60. (200–240 pairs / 8h) **Dip-coating photochromic/hard coating system.**



Key benefits:

- Fully integrated cleaning, hardcoating and photochromic process
- Integrated inspection booth
- Suitable for any ophthalmic substrate due to three discrete coating tanks
- Easily configurable dip processes for complex geometries
- Up to six batches queued to load/ unload due to conveyour infeed and outfeed

Swappable Coating Tank Upgrade

- Different photochromic and tint colours due to multiple storage stations
- Consumable costs down for lower volume productions due to coating bath in two different sizes: one for 6 lens batches and one for 2 lens batches

Key benefits photochromic coating:

- Leading activation darkness
- Totally clear indoors
- Fastest fadeback of any commercially available lens
- 100% UV protection
- Premium abrasion and chemical resistance
- Long photochromic life

Dimensions L D H	2800 mm incl. conveyors 1000 mm 2000 mm
Batch Size	3 pairs or 6 lenses
Process Time	60 minutes
Throughput	200–240 pairs / 8h

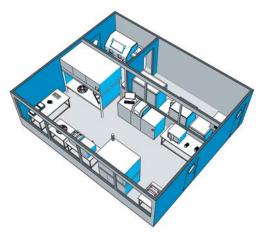


Leybold Optics – lab solutions. **Turnkey installations for Rx lens production.**

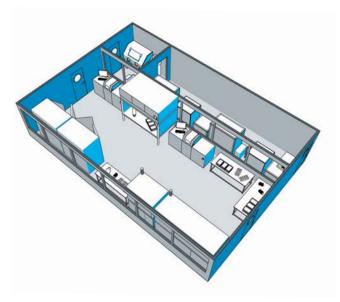
Since 2000 Leybold Optics has installed various sizes of customized lab solutions. From entry-level up to advanced versions Leybold Optics' lab portfolio consists of fully equipped lab solutions based on proprietary anti-reflection coating systems – but tailored to the demands of every single customer in all aspects. A brief site inspection enables us to offer the optimum lab setup for your individual business case.

MINI LAB.





EASY LAB. AR & Hard Coating by Dipping



Productivity overview

System	MINI LAB		EASY LAB		
Hard-coating System	Spinning		Dipping		
Capacity (per Shift)	CCS 610:	From 50 to 160 pairs / 8h			
	BOXER 900:	From 270 to 460 pairs / 8h			
	SYRUS 1100:	From 36	60 to 600 pairs / 8h		

Recommended lab setups

	Mini Lab	Easy Lab
Inspection prior to loading before coating		
DI water system		
Automated ultrasonic cleaning system		
Automated ultrasonic cleaning and hard-coating system		
Automated ultrasonic cleaning, hard-coating and photochromic system		
Curing and /or degassing oven		
Clean-air flow bench with ionizing-air gun		
Warm-water system		
Electrical transformer		
Water chiller		
Stripping unit		
Final quality inspection		
Quality Kit Control with Spectrophotometer		
Gas regulator kit		
Bead (sand) blaster		

The pictures left are showing examples. Leybold Optics engineers will develop the best matching solution that fits customer needs and ambient requirements.

Leybold Optics – lab solutions. **AR testing services and kits.**

Do-it yourself Lens test kit

Perform quality testing in-house, detailed easy-tofollow instruction manual, showing you how to carry out the tests and how to log the results. The kit comes with everything you need to get started and includes on-site training.

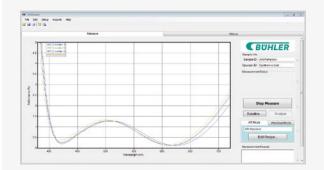


AR color and hard-coat Thickness measurement kit

Maintain your quality inspection by checking the AR reflection color spectrally and minimize returns by checking your hard coat thickness.

Kit contains:

- F10AR/HC spectrophotometer
- Easy to use QC software
- Laptop computer preconfigured and ready-to-go



Test Nr.	Name designation	International Standards or Bühler-SOP
T1	Optical Inspection	DIN-EN-ISO 9211-4
T2	Reflection – Color	DIN-EN-ISO 8990
Т3	Cross hatch – Test	DIN-EN-ISO 9211-4
T4	Surface Tension	Bühler-SOP
T5B	Steel Wool Test (#2)	COLTS-SOP L-11-12-05
Т6	Eraser Test	DIN-EN-ISO 9211-4
Т8	Salt - Water Boiling 10 Cycles	DIN-EN-ISO 9211-4
T13	Environmental Test	Bühler-SOP
T15	QUV Test	Bühler-SOP
T17	Bayer Test (Colts)	COLTS-SOP L-11-12-08
T18	Cheese-Cloth Test	DIN-EN-ISO 9211-4

Leybold Optics processes. **Highest quality AR coatings for any requirement.**

With the upgradeable LEYBOLD OPTICS CCS 610, the versatile BOXER 900 or the SYRUS 1100 vacuum coater included in MINI LAB or EASY LAB, your coating center will have all of the tools necessary to produce the highest quality coatings.



Coatings		CCS 610	CCS 610+	BOXER 900	SYRUS 1100 ECS 1350
AR	JADE PLUS	•			
	BRILLIANT		•	•	•
	OPTIFLEX		•	•	•
	EMINENT		•	•	•
	OPTIFAST			•	•
Hydro	KINGCLEAN			•	•
	SUPERCLEAN			•	•
Mirror and Sun Coatings	OPAL			•	
our obalings	TOPAZ			•	•

Anti-Re	Anti-Reflection Coatings									
	Characteristic	AR	Hardness	Coating Material	Standard	Options	Versions			
Brilliant	Flexible	1,1%		ZrO ₂ -based		<u>م</u>				
Optiflex	Low Reflection	< 1,0 %		$Ti_{_3}O_{_5}$ / Dralo-based		<u>م</u> لا ک				
Eminent	High Durability	< 0,8 %		ZrO ₂ / Alvirit-based	<u>م</u> لا ک					
OptiFast	Fast < 25 minutes	< 1,0 %		Dralo-based		<u>مُن</u> ا ک				

Color Coatings

	Characteristic	Color	Options
Opal	Mirror	Blue; Silver; Gold; Red; Customized	<u>هُ</u>
Topaz	Absorption (15–85%)	Brown; Grey	<u>مُن</u>

Bühler Leybold Optics Processes



Super Hydrophobic



Blue Blocker



Anti-static



Low UV Reflection



Achromatic



Absorption /Transmission Gradient



Blue AR



Mirror Gradient

Bühler Leybold Optics Application Center. For your product development.

Process Development

- Process optimization
- Comparative studies
- R&D projects
- Customized process development

Analysis & Quality Testing

- From visual inspection to QUV long-term tests
- On all kind of thin-film layers (hard-, AR-, mirror-, gradient coatings)
- Detailed sample evaluation

Quality Assurance Packages

- Emergency tests
- Long-term testing agreements
- Training on a large variety of testing tools

Sample Preparation

- Hard coatings
- Anti-reflective coatings
- Mirror coatings
- Spezialized coatings

Training & Lab solutions

- Customized training
- Laquering and Anti-reflective process
- Facility and workflow management



Be it production of qualification samples, development of new processes for new applications, reliability testing of new components or just for training purposes, our Application Center located in Alzenau/Germany is dedicated to provide an excellent level of support and service to our customers. Our engineers and R&D experts are already curious to know how they can support our customers in their development.



Customer support and services. **CS 4.0 – from** customer support/service to customer solutions.

Bühler is where the customer is - connecting machines worldwide to our specialized centers.



Bühler Leybold Optics' relationship with its customer does not end when the machine is delivered, this milestone is the start and continuation of a close partnership. Wherever our customer is, there is Bühler to provide the best services to keep the machine running attending customer specifications. With a constant roll out of unique and innovative solutions, Bühler helps customers achieve success in the marketplace.

Bühler's commitment to its customers:

- Ensuring right support by running your macine in the most efficient way
- Creating customers experience
- Designing customer solution
- Creating customes success









Smart Service Packages Bühler Leybold Optics has smart packages adapted to your needs.

We offer annual contingency allowance of hours, which can be selected in different packages: Bronze, silver and gold or even total care.

Need something different? We will design the ideal service contract to fit your requirements.

Helpdesk – Follow the sun

Always available during business hours. Contact the Helpdesk of your local service or at headquarters. Problems are analyzed immediatly via remote diagnosis.

EUROPE:

+49 6023 500 77 (or +41 71 955 1900) **USA:** +1 919 657 7100 **CHINA:** +86 (0) 67803366-537 IoT – CS 4.0 Anytime and anywhere Optimize your production by using our IoT solution.

Connecting your machine to the cloud can give you the possibility to verify machine status and adjust problems.

Bühler Alzenau GmbH

Business Area Leybold Optics Siemensstrasse 88 D-63755 Alzenau Germany

T +49 6023 500 0 F +49 6023 500 150

leyboldoptics@buhlergroup.com www.buhlergroup.com 190307_Ophthalmic_Optics