PLANT FOR OPTICS

Pure Fine Optics
PFO is an optics manufacturer and internationally operating company, focusing on precision and high-quality optical components and opto-mechanical products under customer’s specification. The production is based on proved and advanced equipment and experience since 1971.

**Key data**

- **Legal form:** privately held joint stock company with registered shares
- **Production area:** 4,204 m² (45,251.48 ft²)
- **Employees:** 280
- **Management Systems:** ISO 9001:2008, OHSAS 18001
OUR HISTORY

1971
The workshop for optics manufacture was set up.

1978
A new modern workshop for precise optical components was set up.

1990
PFO is an autonomous enterprise within the Opticoelectron Optical-mechanical Plant.

2000
PFO is a private limited liability company.

2001

2005
PFO is a joint stock company.

2010
Certification as per ISO 9001:2008 and OHSAS 18001.

2018
Certification as per ISO 9001:2015.
Located in Eastern Europe, in Panagyurishte, Bulgaria, 90 km east of the capital Sofia

Sales in countries in Europe, North America and Asia

Our clients are leading optical companies in Germany, Switzerland, the UK and the USA

Nearly 100% of the manufactured goods are for export
PFO is a 100%/ privately held joint stock company located in the Opticoelectron Industrial park (www.opticoel.com).

The cooperation with the OEG and the other companies of the OE park provides opportunities for:

- Availability and collaboration of a greater number of specialists
- Exchange of know-how
- Greater access (indirect) to the markets
- Use of licensing regimes
- Process optimization – investment management, opportunities to lower costs
WHAT WE OFFER

Our Strengths

80% of our employees have over 10 years of experience

47 years of tradition, expertise and quality in the production of precision optics

High-quality products

Competitive prices

Long-standing cooperation with leading Bulgarian universities (St. Kliment Ohridski University of Sofia, Technical University of Sofia, Paisiy Hilendarski. University of Plovdiv, University of Economics - Varna, Bulgarian Academy of Sciences)

Our own training base to train personnel for optical production

Sound process management – an implemented and working quality management system under ISO 9001: 2008 for more than 15 years
OUR PRODUCTS

Micro lenses
Spherical lenses
Flat optics
Prisms and wedges
IR optics
Reticles
Radii test plates
Optical coatings
Achromatic doublets and triplets
Objective lens, Ocular lens and
Optical-mechanical assemblies
Our many years’ experience, technology and modern equipment allow us to make precise glass blanks such as cut discs from fine annealed optical block and strip glass, prism blanks and color filter blanks made of Schott, Ohara, CDGM optical glasses, fused silica, color filter glasses.
HIGH-PRECISION SPHERICAL OPTICS

Typical specifications:

- Diameter range 1,5 to 110mm, upon a special inquiry – up to 200mm
- Thickness range 0,4 ~ 50mm with tolerance of ± 0,05mm or better
- Radius 1,5mm to infinity
- Form error PV up to lambda/10
- Surface cosmetics - up to 5/2x0,016 acc. to ISO 10110; S/D= 10-5 acc. to MIL-O-13830A
- Centering accuracy up to 30 arc sec
- Lenses with non-round shape
- Black varnishing of lens edge
PRISMS AND PLANO OPTICS

PFO has long-standing traditions in the manufacture of prisms and plano optics.

The range of produced articles is various:

- Right Angle prisms sizes 3 to 100mm, angles ± 3 arc min
- Roof prisms with roof angle 90° ± 3 arc sec
- Pentaprisms
- Dove prisms
- Porro prisms
- Dispersing prisms
- Plane Parallel Round and Square windows
- Cover plates and Protective windows
- Wedge Round and Square windows
- Optical color filters
- Mirrors
- Prism assemblies
- Blackening ground surfaces
PFO has available excellent production facilities with modern equipment and technological know-how for manufacturing of precise IR optical components in various forms.

- IR materials: Ge, Si, ZnS, ZnSe, CaF2, GASIR, IG6, others
- Diamond turning of parts up to 250mm diameter by SPDT on Ultra-precision diamond turning lathe
- Surface machined by SPDT: plano, spherical, aspherical, aspheric-diffractive surfaces, free form
- Traditional polishing of IR lenses and protective windows with round and non-round shapes
- HEAR IR coatings for MWIR and LWIR ranges
- DLC coating on Ge and Si components for MWIR and LWIR ranges.

- Metrology:
  Contact measurement and critical analysis of optical surface profile by Form Talysurf PGI Optics
  Measurement of flat and spherical surfaces by Fizeau interferometer XONOX VT 1200 PS with phase shifting fringe analyzing system, various f/number Transmissions Spheres 4”+ are available
  Non-contact scanning of surface profile with sub-nanometer precision by white light interferometer ZeGage plus 3D Optical Profiler
  Precise and robust contact measurement of lens central thickness on ground, polished and coated optics in production as well as in quality inspection by measuring system XONOX CT 200 IV
OPTICAL COATINGS

PFO use softwares TFCalc and FilmStartm for design, control and analysis of optical thin films, to make PVD optical coatings in vacuum coating systems using different evaporation sources, as thermal resistive heating source, E-gun and Ion Assistant source. Reflectance and Transmittance measurements are done by sophisticated spectrometers Perkin Elmer Lambda 950 and PHOTON RT for UV-VIS-NIR, Shimadzu for IR range.

Coating capabilities

- Single layer coating
- Multi-layer Broadband AR coatings (BBAR)
- Beamsplitting coating (metal or dielectric layers)
- Filter coatings (cut-off and band-pass filters)
- Reflective mirror coatings (metal, dielectric)
CEMENTING & ASSEMBLING

Optical cementing

Achromats
Triplets
Prism groups
Lens-prism groups

We use stress free technology of optical bonding, using UV and two-components optical adhesives, which ensures pre-and final cure of cement without stress and deformation of optical surfaces after bonding is completed.

Opto-mechanical assembling

PFO integrates optical components into complex subassemblies. We use for assembling precise mechanical parts, which are black matt anodized, optional black painted coatings to assemble high-end quality opto-mechanical units with low level of stray light.
The technological process is a photolithography contact method for application of reticle pattern on glass substrates.

Typical specifications:

- Transparent background with etched and filled in lines by TiO2 / ZrO2 and paint. Typical line width 10 ± 3 microns, others line width is available upon customer request.
- Transparent background with chromium lines. Typical line width 6 ± 1 micron, others line width is available upon customer request.
- Non-transparent chromium background and transparent lines. Typical line width 6 ± 1 micron, others line width is available upon customer request.
- Typical distance tolerance between patterns up to ± 3 microns.
- Centering better than 0.1 mm of reticle lines with respect to outside diameter of glass substrate.
- Optional coatings: AR coatings on both sides of reticle, applied after photolithography.
- Quality inspection of widths and distances is done on measuring microscopes MITUTOYO and VICKERS with accuracy of 1 micron.
Quality Inspection of Incoming Products

Qualified trained staff is carried out quality control of incoming materials and products quality for manufacture in accordance with ISO 9001 procedures.

All stages Quality Control

PFO apply precise 100% control of all stages of the production process for an high-end quality required by the customer, using measuring tools and devices of leading companies in metrology.
TEST & INSPECTION END PRODUCTS

Measurement of most common type parameters of lenses and assembled unit such:
Total spectral transmission of assembled units EFL, BFL and FFL, MTF on/off axis, Resolution of the image of USAF 1951 target, Effective focal length, Distortion, Vignetting, Relative transmittance

Environmental tests:
Temperature cycles in range -40° to +80°
Relative humidity range 10% to 90%
Vibrations and shock tests

PFO provide test reports and full documentation of our services according to customer specifications and international standards:
ISO-10110
MIL-O-13830
MIL-C-48497
and more
VIDEO PRESENTATION
CONTACT US

Plant For Optics
Bulgaria, 4500 Panagyurishte
Industrial area Opticoelectron
Tel.: +359 357 62156
Fax: +359 357 63316
E-mail: pfo@opticoel.com
www.pfo-bg.com
www.opticoel.com