Large Optics

One of Tydex main lines of business is the production of large optic components intended to solve various research, engineering, and production problems. These components measure from 100 mm to 1300 mm and include windows, lenses, mirrors, prisms, and various nonstandard elements with unique specifications. The Company's capabilities to produce one component or another depend on many factors, including material, geometry, accuracy, and field of application. Despite the wide range of products offered by Tydex, here are some specifications to gain an idea of our production potentialities in this field.

GENERAL SPECIFICATIONS FOR TYDEX LARGE OPTICS:

Types of products:

Transmission optics

- Windows (plane-parallel, wedge-shaped);
- Lenses (meniscus, biconvex, biconcave, plano-convex, plano-concave);
- Special transmitted-light elements.

Reflection optics

- Plane mirrors (rectangular, circular, diagonal);
- Spherical mirrors (concave and convex);
- Aspherical mirrors:
  - Axis (parabolic and hyperbolic);
  - Off-axis (parabolic);
- Special reflected-light elements.

Mixed-type optics

- Beam splitters (on plane-parallel and wedge-shaped substrates);
- Special elements with partially reflecting (transmitting) coatings of effective surfaces;
- Special elements with reflecting and transmitting coatings of irregular shape on one surface;
- Prisms with some surfaces transmitting light and other surfaces reflecting it.

Fields of application

The main field of application of Tydex's large optics is astronomy and relevant applications. Moreover, many optical components are produced to complete various illumination, scanning, and lidar systems, laser systems, and testing systems having applied importance and intended to solve research and engineering problems. These fields of application determine the stringent surface quality and accuracy, QA, and data-processing requirements to be met by Tydex's optics.

Materials

Large optical components are made of various materials which are selected considering their availability, fields of application, operating conditions for the product, and specifications. For example, materials for transmission optics have high transmission factors in wavelength ranges specified by the Customer. Such components are manufactured from Russian, German (Schott), and Japan (Ohara) optical glasses and fused silica. Reflecting and mixed-type optics can be made of the same materials, depending on their cost and field of application. Moreover, special materials can be used to make mirrors. For example, astronomical mirrors are made from Sitall CO-115M (Astrositall, an analogue of Zerodur) with an extremely low coefficient of thermal expansion. This material was specially developed for high-precision reflecting optics.

Since the optics involved is large-sized, it should be remembered that the choice of such materials is restricted by the maximum possible size, which may limit their use for solving certain problems in the field.

Surface accuracy

The best possible accuracy that can be ensured depends on a variety of factors of which most important are the type of material and the linear dimensions of the product. However, the experience of our opticians and the available instruments and special equipment allow our company to produce optics with a wavefront accuracy of L/10 at 633 nm which is equal to a surface accuracy of L/20.

Surface quality

All our products fully comply with the internationally recognized MIL-0-13830A standard. The surface quality of the mirrors produced by the company depends on their dimensions:

- 60/40 scratch/dig for linear dimensions up to 400 mm;
- 80/50 scratch/dig for linear dimensions up to 800 mm;
- 120/80 scratch/dig for linear dimensions more than 800 mm.

This parameter depends on the type of material and the surface accuracy of the product.

Coatings

Protected aluminum is our most popular coating for reflecting optics. Transmitting components are coated with antireflection films optimized to fit the wavelength range required. Upon the Customer's request, we can apply coatings of other types, if the Company's capabilities allow. These coatings together with maximum diameters are listed in the table below:

№	Type of coating	Maximum diameter
1	Antireflection coatings	400
2	High reflection dielectric mirror coatings	280
3	Partial reflection dielectric coatings	280
4	Wavelength separating/combining coatings	280
5	Hot/Cold mirror coatings	280
6	Protected Aluminum coating	1500
7	Protected Silver coating	400
8	Protected Gold and bare Gold coatings	400
9	Enhanced metal (Al, Ag, Au) coatings	300
10	DLC	300 x 400

Should the operational need arise, we can undertake to apply coatings to components of other types or larger dimensions than those specified in the table. Well-established links to many specialized subcontracting companies (including foreign ones) allow us to extend our capabilities considerably. Therefore, please contact us to inquire about our production potentialities even in «exotic» cases.

DIMENSIONS AND STANDARD SPECIFICATIONS

Flat mirrors of round shape

- Linear dimensions: from 100 mm to 1000 mm;

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TYDEX®

Large Optics

- Wavefront accuracy: up to L/8 at 633 nm (or surface accuracy L/16)

Diagonal plane mirrors

- Minor axis dimension: from 30 mm to 250 mm;
- Wavefront accuracy: up to L/8 at 633 nm (or surface accuracy L/16)

Spherical mirrors

- Diameters: from 100 mm to 1300 mm;
- Wavefront accuracy: up to L/8 at 633 nm (or surface accuracy L/16);
- Standard numerical apertures: F/3-F/10

Axis parabolic and hyperbolic mirrors

- Diameters: from 200 mm to 1300 mm;
- Wavefront accuracy: up to L/8 at 633 nm (or surface accuracy L/16);
- Standard numerical apertures: F/3-F/10

Off-axis parabolic mirrors

- Diameters: from 70 mm to 650 mm;
- Wavefront accuracy: up to L/5 at 633 nm (or surface accuracy L/10);
- Standard numerical apertures: F/3-F/10;
- Standard off-axis angles: 10°-30°

Optical windows

- Maximum linear dimension: 1000 mm;
- Wavefront accuracy: up to L/8 at 633 nm (or surface accuracy L/16)

Optical lenses

- Diameters: from 80 to 400 mm;
- Surface accuracy: L/2 at 633 nm

Standard astronomical systems

- Diameters of primary mirrors: from 400 mm to 1300 mm;
- Wavefront accuracy (of a ready-assembled system): L/8 at 633 nm (or surface accuracy L/16);
- Standard numerical apertures of primary mirrors: F/3-F/10;
- Standard numerical apertures of systems: F/7-F/20

Quality assurance

While manufactured, each large optical component is subjected to multistage quality control. The optics manufactured is inspected by two independent quality control departments and carefully tested. The results of testing are documented in a test certificate where all specified and measured parameter values are indicated. Products of each type are subjected to an individual QA procedure, which ensures unambiguous interpretation of the results obtained. For example, the accompanying documentation for each astronomical system includes two test certificates for the primary mirror and the entire system, interferograms (including negatives) for the primary mirror and the entire system, and the results from a numerical analysis of the interferograms.

The above types of products and their specifications are standard and do not exhaust all the range of products that can be offered. For more about the Company's production potentialities, price quotation and delivery please fill in our Request form.

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