Precision Optical Engineering

Products:
- Prisms
- Windows
- Mirrors
- Flats and Master angles
- Sight Glasses

Key Features:
- Prisms (Contacted, Cemented, AR coated, Mounted)
- Windows (Flat, wedged, curved, drilled, recessed, AR coated)
- Flats and Master angles (Up to 500mm, coated, zero expansion materials, traceable)
- Sights (Optical, borosilicate and soda glass, curved surfaces, thermally or chemically toughened, AR coated)

Compliance:
ISO 9001

This datasheet presents the non polarising optics category of components made by Gooch and Housego, this category encompasses devices of various geometrical shapes and sizes which are employed for folding, inverting, reverting, displacing, and deviating a beam of light, where this beam may be converging, diverging or collimated.

Gooch and Housego produces several types of prisms, which depending on the prism’s intended application can be classified as right angle, Porro, Abbe, Dove, Amici, Schmidt, Leman, Penta, Zeiss, Rhomboid, etc. Windows produced by Gooch and Housego are made of optical glass with ground and polished faces. The faces may be parallel, wedged or of a custom geometrical aspect. Windows are generally employed as a transparent interface between two physical environments, therefore window selection considerations include: material transmission, thickness, scattering, wave front distortion, parallelism and resistance to certain environments such as high temperature or pressure.

Optical flats are used to check the flatness of reflective surfaces in combination with a monochromatic light source. Gooch and Housego manufacture optical flats from Zerodur®, Pyrex, or customer specified material in sizes up to 500mm with flatness to λ/20.

Gooch and Housego also manufactures mirrors and sights to special requirements to the highest quality for a range of materials including customer specific traceable metallic or multilayer coatings.
General product specifications (Windows, Mirrors, Prisms, Flats, Master angles)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification / Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Zerodur, Pyrex, All customer specific glasses</td>
</tr>
<tr>
<td>Size / thickness /Geometry</td>
<td>To drawing</td>
</tr>
<tr>
<td>Surface Quality</td>
<td>10/5 scratch/dig or better</td>
</tr>
<tr>
<td>Parallelism</td>
<td>0.5 arc seconds</td>
</tr>
<tr>
<td>Wavefront Distortion</td>
<td>Generally to 5A/20 @ 633nm</td>
</tr>
<tr>
<td>Dimensional Tolerance</td>
<td>Sub micron</td>
</tr>
<tr>
<td>Angular Tolerance</td>
<td>Arc second</td>
</tr>
<tr>
<td>Clear aperture dimensions¹</td>
<td>Up to 500mm</td>
</tr>
<tr>
<td>Mounted/unmounted</td>
<td>Specify</td>
</tr>
<tr>
<td>Wavelength range</td>
<td>Specify</td>
</tr>
<tr>
<td>Damage Threshold</td>
<td>10J/cm² @ 3ns pulse (1064nm)</td>
</tr>
<tr>
<td>Coating</td>
<td>Specify</td>
</tr>
<tr>
<td>Operating &amp; storage conditions</td>
<td>Specify</td>
</tr>
</tbody>
</table>

¹. Operating & storage conditions

Customer specific enquiries

The majority of our customers require custom components manufactured and coated to their own demanding specifications. Please send your specification to sales@goochandhousego.com or contact your local sales representative do discuss your requirements.

We also do:

- Acousto-Optics
- Electro-Optics
- Non Linear Optics & Infra Red Optics
- Fibre Optics
- RF drives
- Coatings
Optics
Manufacturing Services

• Crystal optics & custom optics
• Value added services
• Coatings

MATERIALS
Optical Glasses
Fused Silica / Quartz
Sapphire
Crystal Quartz
Calcite
Lithium Niobate
Other Crystalline Materials
Zerodur®
Borosilicate Glass
Thin Substrate Glasses
Alumina Ceramics
Ferrite

GLASS ENGINEERING
Multi-Axis CNC Machining
Drilling And Polishing Of Holes
Very Small / Thin Components
Toughening
Acid Etching
Ground / Lapped Surfaces

COATINGS
Anti-Reflection - broadband, v-coat
Reflectors - metals Al, Ag, Au, platinum, HR dielectric
Beamsplitters

ASSOCIATED PRODUCTS
Ceramic Components
Piezo-Electric Crystals - quartz, tourmaline, (lithium niobate)
Transducers

OPTICS
Windows
Lenses - spherical
Lenses - cylindrical
Lens Assemblies
Prisms - all types: roofs, penta, Schmidt etc
Beamsplitters
Filters
Optical Flats
Mirrors - most types
Custom-Made Items

POLARISING / LASER OPTICS
Waveplates - any order
Waveplate Assemblies
Birefringent Filters
Rotators
Calcite Prisms e.g. Glan-Laser
Quartz Prisms e.g. Wollaston

MEASUREMENT
Angular - to sub arc second
Zygo Interferometer
Co-Ordinate Meas. Machine
X-Ray Goniometer
Spectrophotometers: 200 to 1800nm

SERVICES
Mounting
Sub-Assembly
Painting
## Precision Optics Capabilities sheet

<table>
<thead>
<tr>
<th>Optics</th>
<th>Non Polarizing Optics</th>
<th>Polarizing and Laser Optics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>Fused silica, Borosilicate glass, Thin substrate glasses, Zerodur, Silicon and majority of optical glasses.</td>
<td>Quartz, Sapphire, Calcite, Other crystalline materials,</td>
</tr>
<tr>
<td></td>
<td>Ceramic components, Piezo-Electric Crystals, Alumina, Ferrites, Tourmaline, Lithium Niobate, Silicon Carbide.</td>
<td></td>
</tr>
<tr>
<td>Coatings</td>
<td>AR and HR coatings, Broadband, V-coat Reflectors, Metal coatings such as Al, Ag, Au, Platinum, Rhodium.</td>
<td></td>
</tr>
<tr>
<td>Material Processing</td>
<td>Multi-Axis CNC Machining, Drilling and polishing of holes, Micro-optics and thin components, Toughening, Acid Etching, Ground / Lapped Surfaces, Polished surfaces, Magnetorheological surface form correction.</td>
<td></td>
</tr>
<tr>
<td>Metrology</td>
<td>Angular -to sub arc second, Zygo Interferometry, Coordinate measuring machines, X-Ray Goniometry, Ellipsometry, Spectrophotometers: 190nm to 3200nm.</td>
<td></td>
</tr>
<tr>
<td>Value Added Services</td>
<td>Mounting, Sub-assembly, Painting, Optomechanical design, Coating design.</td>
<td></td>
</tr>
</tbody>
</table>
## Surface quality

<table>
<thead>
<tr>
<th>Surface quality</th>
<th>Manufacturing tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratch-dig MIL-PRF-13830B ISO 10110</td>
<td>10-5</td>
</tr>
<tr>
<td></td>
<td>5/L1x0.001, 5/1x0.05</td>
</tr>
</tbody>
</table>

- **Surface Roughness (Å, Rₐ)**: 1
- **Flatness irregularity (waves, P-V@ 633nm)**: 0.025
- **Spherical irregularity (waves, P-V@ 633nm)**: 0.025
- **Spherical Radius (fringes)**: 3

## Surface tolerances

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Volumetric tolerances</th>
<th>Manufacturing tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 500mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Length (mm)   | Up to 500mm           | +0.000/-0.025 |
|               |                       | +0.000/-0.025 |
| Thickness (mm)| 5/L1x0.025            | ±0.025        |
| Centration (mm)|                        | 0.01          |
| Wedge         | ≤ 1 arc sec            |                |
| Clear Aperture (%) |                  | 90             |

## Volumetric tolerances

- **Diameter (mm)**: +0.000/-0.025
- **Length (mm)**: +0.000/-0.025
- **Thickness (mm)**: ±0.025
- **Centration (mm)**: 0.01
- **Wedge**: ≤ 1 arc sec
- **Clear Aperture (%)**: 90

## Dimensional fabrication tolerances

<table>
<thead>
<tr>
<th>Absorption (%)</th>
<th>E-beam</th>
<th>Ion Assisted Deposition</th>
<th>Ion Beam Sputtering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scatter (%)</td>
<td>&lt; 0.2</td>
<td>&lt; 0.02</td>
<td>&lt; 0.02</td>
</tr>
<tr>
<td>Surface Roughness (Å rms)</td>
<td>5</td>
<td>7</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Wet/Dry Shift (range) (%)</td>
<td>&lt; 0.8</td>
<td>&lt; 0.3</td>
<td>0</td>
</tr>
<tr>
<td>Laser Damage threshold</td>
<td>15 J/cm² (3ns)</td>
<td>&gt; 15 J/cm²</td>
<td>&gt; 27 J/cm²</td>
</tr>
</tbody>
</table>

## Coating tolerances