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Metax

# Microlenses

The lens selection chart gives an overview of lenses currently available in our stock range. Details of the lenses are given in the selection tables and specification.

Lenses with other combinations of focal length/diameter can be made. A 'semi-custom' lens, made using an existing tool, might meet your requirements; please specify nominal focal length and diameter. We can also supply plano- and bi-concave lenses, flat windows, prisms, etc. WE INVITE YOUR ENQUIRIES.

Microlenses can also be specially made to your specific requirements, within the overall focal length and diameter range shown in the chart.

To enable us to quote for manufacture of special lenses we require the following information:–

- Equivalent and/or back focal length
- Diameter of finished lens
- Wavelength range (or reference wavelength) for which lens is to be used
- Tolerances (if different from standard tolerances shown in our stock lens specification)
- Centre or edge thickness (with tolerance) if specific value required
- Glass – BK7 or Optical Crown glass will be used unless otherwise specified

## Microlens Selection Chart — Convex Lenses

| NOMINAL FOCAL LENGTH (mm) | LENS DIAMETER (D) (millimetres) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25 | 20 | 15 | 14·5 | 12·5 | 10 | 8 | 6 | 5·5 | 5·0 | 4·5 | 4·0 | 3·5 | 3·0 | 2·5 | 2·0 | 1·5 |
| 100 | | | | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | | | | |
| 42 | | | • | | | | | | | | | | | | | | |
| 25 | | | • | | | • | | • | | | | | | | | | |
| 22 | | | × | | | | | | | | | | | | | | |
| 20 | | | | | | | • | | | | | | | | | | |
| 17 | | | | | | • | | | | | | | | | | | |
| 15 | | | | × | | | | • | | | | | | | | | |
| 12·5 | | | | | | | | × | | | | | | | | | |
| 10 | | | | | | × | | • | | | | | | | | | |
| 8·0 | | | | | | | | × | | | | • | | | | | |
| 6·0 | | | | | | | | | • | | | | • | | | | |
| 5·5 | | | | | | | | | | | × | | | | | | |
| 4·5 | | | | | | | | | | | | • | | | • | | |
| 3·5 | | | | | | | | | | | | | | | | ○ | |
| 2·5 | | | | | | | | | | | | | | | • | | |
| 2·0 | | | | | | | | | | | | | | | | | |
| 1·5 | | | | | | | | | | | | | | | | | ○ |

LENSES CURRENTLY AVAILABLE FROM STOCK SHOWN THUS:—

• PLANO-CONVEX

× BI-CONVEX

## Specifications common to all stock microlenses

The equivalent and back focal lengths shown in the tables are paraxial values, at the reference wavelength.

| | | Tolerance |
|---|---|---|
| Equivalent focal length | (f) | +/– 3% |
| Centre thickness | ($t_c$) | +/– 0.1 mm |
| Lens diameter | (D) | +/– 0.1 mm |
| Refractive index of glass | ($n_d$) | +/– 0.001 |
| Centration | | 3′ of arc |
| Surface quality | | Scratch and dig better than 80–50 |

All surfaces are optically ground and fine polished. Curved surfaces fit test plate to within 3 fringes; plane surfaces are flat to within 3 fringes.

The circumference edge is fine ground. Plane surfaces have a slight protective chamfer; curved surfaces have a slight protective chamfer where necessary.

All lenses are uncoated.

## Glass Constants

**BK7 Glass** $n_d = 1.51680$ $V_d = 64.17$
$n_e = 1.51872$ $V_e = 63.96$

**Optical Crown Glass** $n_d = 1.523$
$n_e = 1.525$

## Wavelength

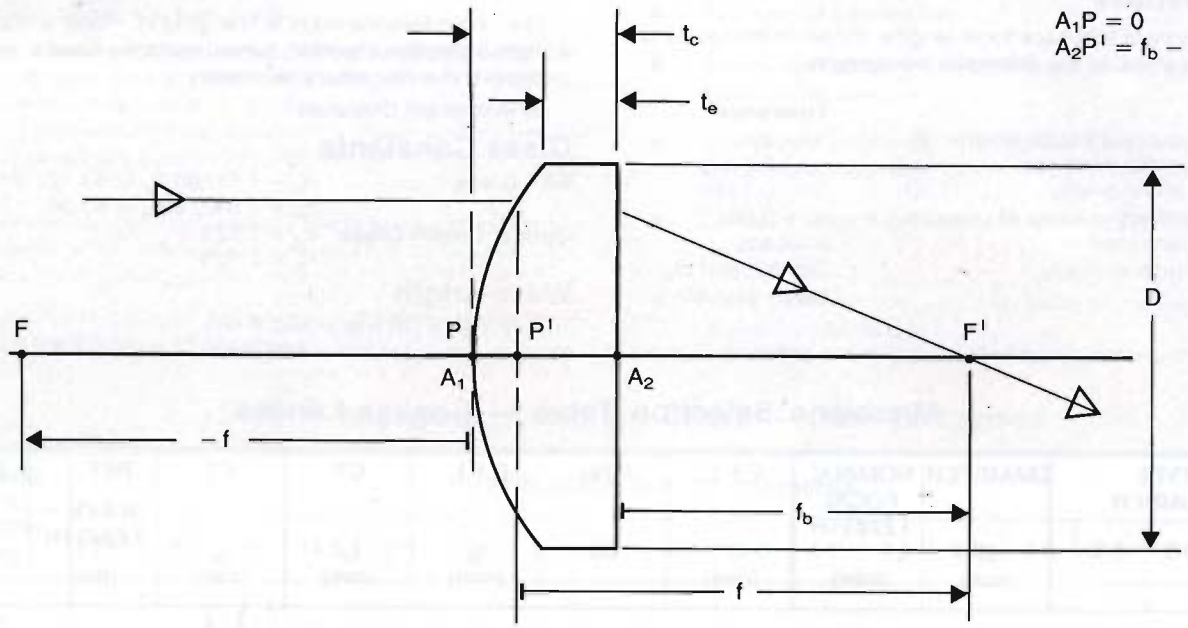
Helium yellow (d) line = 587.6 nm
Mercury green (e) line = 546.1 nm

## Microlens Selection Table — Convex Lenses

| TYPE NUMBER | DIAMETER D (mm) | NOMINAL FOCAL LENGTH (mm) | E.F.L. f (mm) | F/No. f/D | B.F.L. $f_b$ (mm) | CT $t_c$ (mm) | ET $t_e$ (mm) | REF. WAVE – LENGTH (nm) | GLASS |
|---|---|---|---|---|---|---|---|---|---|
| **PLANO-CONVEX LENSES** (shown • on chart) | | | | | | | | | |
| 0281 PX | 15·0 | 42 | 42·3 | 2·82 | 40·3 | 3·0 | 1·7 | 546·1 | BK7 |
| 0291 PX | 15·0 | 25 | 25·3 | 1·68 | 22·5 | 4·2 | 1·8 | 546·1 | BK7 |
| 0301 PX | 10·0 | 25 | 25·3 | 2·53 | 23·6 | 2·5 | 1·5 | 546·1 | BK7 |
| 0311 PX | 10·0 | 17 | 17·0 | 1·70 | 15·0 | 3·0 | 1·4 | 546·1 | BK7 |
| 0321 PX | 8·0 | 20 | 20·2 | 2·53 | 18·6 | 2·5 | 1·7 | 546·1 | BK7 |
| 0331 PX | 6·0 | 25 | 25·3 | 4·21 | 23·6 | 2·5 | 2·2 | 546·1 | BK7 |
| 0341 PX | 6·0 | 15 | 15·0 | 2·51 | 13·4 | 2·5 | 1·9 | 546·1 | BK7 |
| 0351 PX | 6·0 | 10 | 10·4 | 1·74 | 8·8 | 2·5 | 1·6 | 546·1 | BK7 |
| 0361 PX | 5·5 | 6·0 | 6·1 | 1·11 | 4·1 | 3·0 | 1·4 | 546·1 | BK7 |
| 0371 PX | 4·0 | 8·0 | 8·3 | 2·08 | 7·0 | 2·0 | 1·5 | 546·1 | BK7 |
| 0381 PX | 4·0 | 4·5 | 4·4 | 1·10 | 3·1 | 2·0 | 0·82 | 546·1 | BK7 |
| 0391 PX | 3·5 | 6·0 | 6·1 | 1·75 | 4·8 | 2·0 | 1·5 | 546·1 | BK7 |
| 0401 PX | 2·5 | 4·5 | 4·4 | 1·76 | 3·3 | 1·7 | 1·3 | 546·1 | BK7 |
| 0411 PX | 2·5 | 2·5 | 2·5 | 1·00 | 1·4 | 1·7 | 0.75 | 546·1 | BK7 |
| **BI-CONVEX LENSES (SYMMETRIC)** (shown × on chart) | | | | | | | | | |
| 0421 BX | 15·0 | 22 | 21·9 | 1·46 | 20·4 | 4·5 | 1·9 | 546·1 | BK7 |
| 0431 BX | 14·5 | 15 | 15·3 | 1·06 | 13·2 | 5·9 | 2·2 | 546·1 | OPT. CRN. |
| PLANO-CONVEX LENSES – HIGH REFRACTIVE INDEX (shown o on chart) | | | | | | | | | |
| 0511 HPX | 2·0 | 3·5 | 3·6 | 1·78 | 2·9 | 1·2 | 1·0 | 546·1 | SF 11 |
| 0531 HPX | 1·5 | 1·5 | 1·64 | 1·09 | 0·97 | 1·2 | 0·96 | 546·1 | SF 11 |

SF 11 Glass : $n_d$ 1·78472 $n_e$ 1·79190

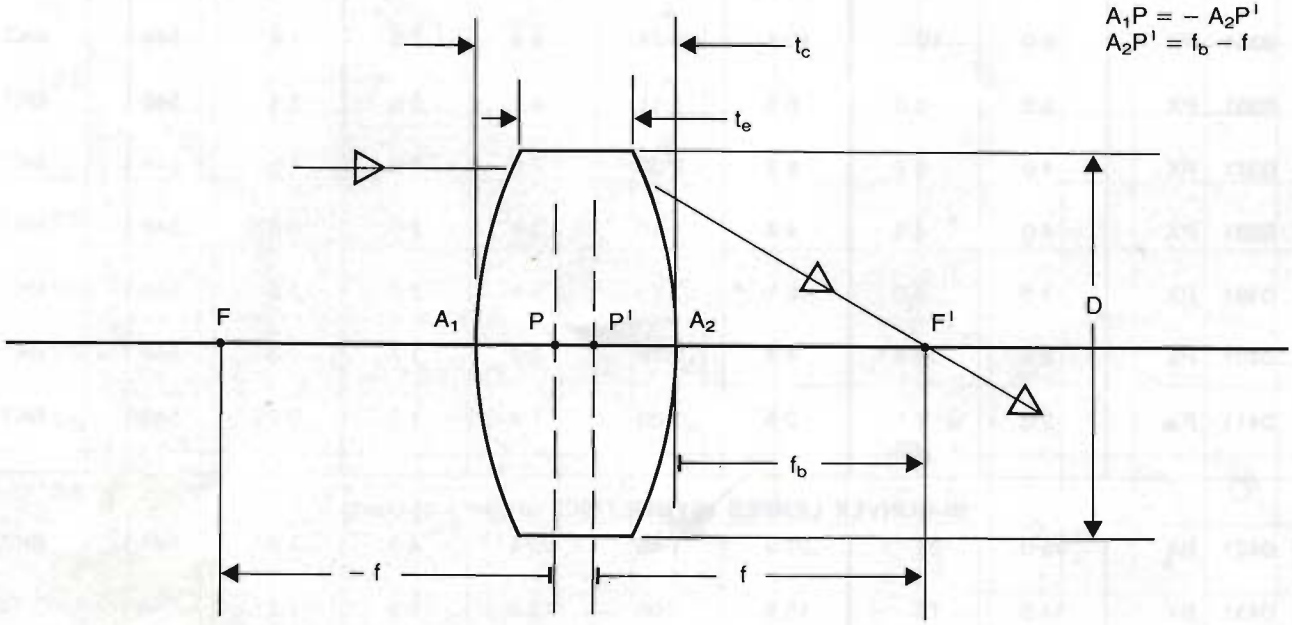
## Plano-convex lens




Plano-convex lenses are the best choice for collimating the light from a near source, or for focusing the image of an infinite or distant source or object. For an infinite conjugate ratio, a plano-convex lens used, as shown in the diagram, with the convex surface towards the incident collimated light, closely approximates the "best-form", resulting in minimum spherical aberration. Conversely, when collimating the light from a near source lying at the focal point, the plane surface should face the source for best results. In general, for other object and image distances, the convex surface should lie towards the longer conjugate.

Pairs of plano-convex lenses, generally with the convex surfaces facing each other, are often used as condensers.

## Bi-convex lens (symmetric)




Bi-convex lenses are the best choice for use with a near object and image. At unit magnification (conjugate ratio = 1), with object and image at equal distances (2 × focal length) from the lens, the spherical aberration of a bi-convex lens is the minimum that can be achieved with a single lens, also coma, distortion and chromatic aberration are all minimized. The aberrations increase as the conjugate ratio departs from unity; for ratios less than ⅕ or greater than 5 (approximately) a plano-convex lens is likely to give better results.

The minimum separation between a real object and a real image (4f, ignoring lens thickness) occurs at unit magnification. Object and image distances are measured respectively from P and P', the principal points.