

## Reflecting Objective Lens Data Sheet

### Description

Reflecting objectives are renowned for their unique optical properties. Beck Optronic Solutions is one of very few companies worldwide designing and manufacturing them. Originally designed for microscopy in 1904, they are based upon a two-mirror system. The all-reflecting optics mean that, in contrast to refracting objectives, they are totally free from chromatic aberrations. By careful selection of the mirror curvatures and their separation, they are corrected for spherical aberration, coma, and astigmatism, leading to diffraction limited imaging performance. In addition to these corrections, reflecting objectives have the following advantages when compared to standard refracting microscope objectives:

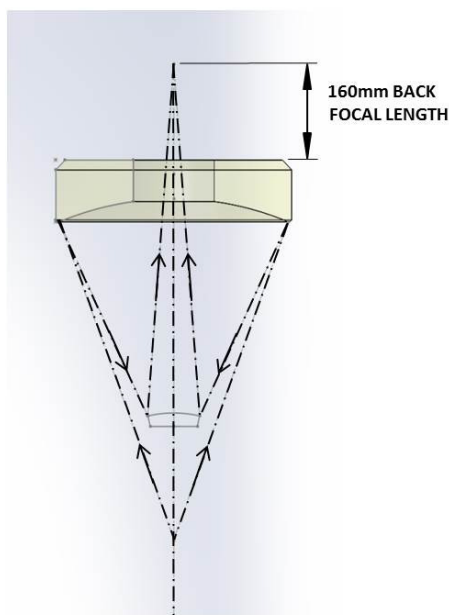
- Longer working distances relative to the magnification;
- Large numerical apertures for improved light gathering power;
- High throughput from UV to far infrared;
- Coatings available to enhance performance at specific wavelength regions.



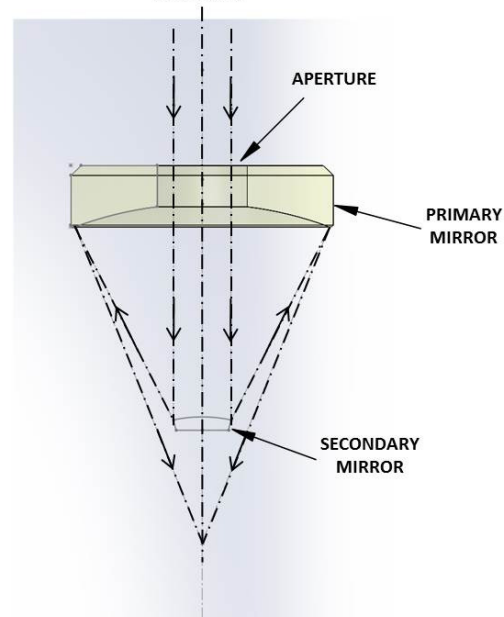
Applications include conventional microscopy and beam delivery systems. With their unique lack of chromatic aberrations, they excel especially where a dual wavelength operation is required, such as alignment to a visible beam for working with an IR or UV beam laser. Other uses include:

- Two-photon microscopy
- FT-IR spectroscopy;
- UV metrology and microscopy;
- Semiconductor wafer inspection;
- Photomicroscopy;
- Photolithography;
- Thin film measurements;
- Laser beam delivery systems;
- Laser drilling and etching;
- Product marking;
- Laser pumping;
- Thermal imaging microscopy.

A) MICROSCOPY



B) BEAM DELIVERY SYSTEMS

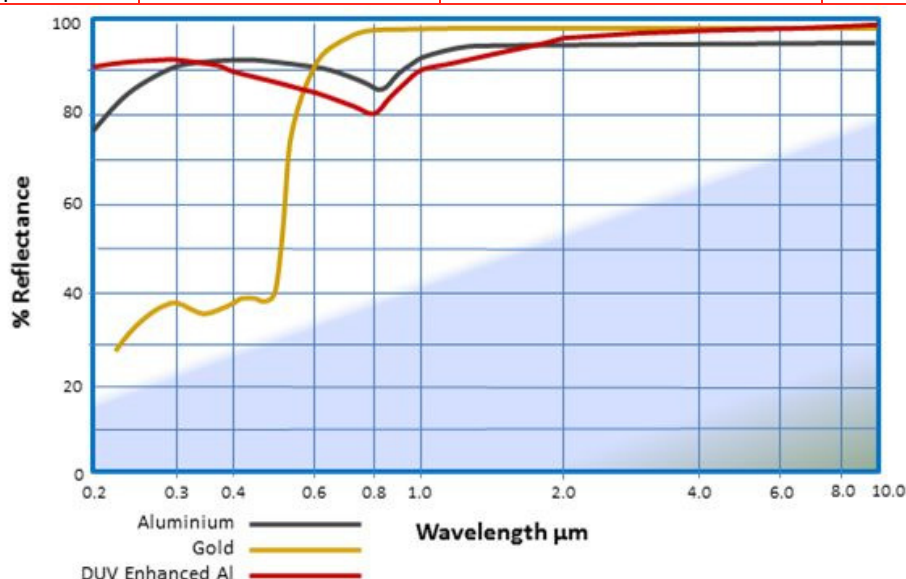


| Property                                                | Beck Optronic Solutions Model No              |                     |                     |               |                |                |
|---------------------------------------------------------|-----------------------------------------------|---------------------|---------------------|---------------|----------------|----------------|
|                                                         | 5001-000                                      | 5002-000            | 5003-000            | 5004-000      | 5006-000       | 5007-000       |
| Magnification                                           | x15                                           | x15                 | x25                 | x36           | x52            | x74            |
| Numerical aperture                                      | 0.28                                          | 0.50                | 0.40                | 0.50          | 0.65           | 0.65           |
| Focal length (mm)                                       | 13.35                                         | 13.41               | 8.00                | 5.41          | 3.55           | 2.54           |
| Visual FOV (mm)                                         | 1.20                                          | 1.20                | 0.72                | 0.50          | 0.34           | 0.24           |
| Obscuration                                             | 25.0%                                         | 21.5%               | 22.5%               | 13.0%         | 17.5%          | 15.0%          |
| Transmitted wavefront error                             | $\leq \lambda/4$ P-V, $\lambda/14$ RMS @633nm |                     |                     |               |                |                |
| Working distance (mm)                                   | 24.5                                          | 23.2                | 14.5                | 8.6           | 1.8            | 1.0            |
| Small mirror diameter (mm)                              | 7.30                                          | 13.40               | 6.30                | 5.60          | 4.60           | 3.35           |
| User adjustment for tube-length & cover glass thickness | Fixed (factory set)                           | Fixed (factory set) | Fixed (factory set) | Yes           | Yes            | Yes            |
| Range of cover glass thickness                          | 0 – 3.0mm*                                    | 0 – 3.0 mm*         | 0 -3.0 mm*          | 0 – 1.0 mm    | 0 - 1.0 mm     | 0 – 1.0 mm     |
| Range of tube length (mm)                               | 80 - $\infty$ *                               | 80 - $\infty$ *     | 80 - $\infty$ *     | 90 - $\infty$ | 120 - $\infty$ | 120 - $\infty$ |

\* Factory set for one cover glass thickness and one tube length. To be specified at the time of ordering

The standard objectives are supplied with aluminium coated mirrors. This gives the widest spectral coverage from UV to far IR, but limits the objective to low power use only. In applications requiring high power, we offer alternative coatings as detailed below. For specialised applications we can provide other specialist coatings.

| Range                | Reflectance   | Coating                | Suffix |
|----------------------|---------------|------------------------|--------|
| 250 nm to 10 $\mu$ m | 89.0% average | Aluminium              | -000   |
| 190 nm to 10 $\mu$ m | >89.0%        | DUV Enhanced Aluminium | -190   |
| 700 nm to 15 $\mu$ m | 98.0%         | Gold                   | -120   |



**Note:** Our standard objectives have a 3-legged spider (to support the secondary mirror) which minimises diffraction but produces a six-point flare pattern. A 4-legged spider produces more diffraction but only has a 4-point flare pattern and some users prefer this. Add postfix 4 to part number for a 4-legged spider when you order (3 legs are supplied as standard).

**Note:** If back reflections may be an issue in your application a matt black dimple can be ground into the secondary (smaller) mirror. Add postfix -D to the part number. If you require a clearance hole through the secondary mirror, please contact us to discuss the options available.

#### About Beck Optronic Solutions

Beck has a reputation for excellence in design and manufacture of precision optics that can be traced back over 175 years. Based near London, UK, Beck delivers complex, integrated electro-optic systems for defence and commercial use across the electromagnetic spectrum from UV to LWIR. **For pricing or further information please contact us at:**

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