



OZ OPTICS LTD.

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FIBER COLLIMATORS/FOCUSERS

FEATURES:

- High power handling
- Rugged and compact design
- Low insertion loss
- Low backreflection
- Wide wavelength range
- Wide range of beam diameters
- GRIN, aspheric, achromatic, plano-convex, and biconvex lenses available
- Singlemode, multimode, and polarization maintaining Fiber versions
- Pigtail and receptacle versions
- Diffraction limited optics
- Adjustable focusers
- **LOW COST!**

APPLICATIONS:

- Fiber optic device packaging, including WDM's Splitters, and integrated optics
- Source to fiber coupling
- Fiber to detector coupling

SPECIFICATIONS:

- **Wavelength:** 180nm - 2000nm
- **Backreflection:** -25, -40, -50, and -60dB
- **Connector types:** NTT-FC/PC, Super NTT-FC/PC, Ultra NTT-FC/PC, Angled NTT-FC/PC, SC, Angled SC, AT&T-ST, SMA905, SMA906
- **Polarization Extinction ratios:** 20, 25, or 30dB
- **Beam Diameters:** 0.2 to 22mm
- **Spot size:** As small as <5 microns
- **Wavefront distortion:** $\lambda/4$ to $\lambda/10$
- **Insertion Loss:** ≤ 0.6 dB for 60mm separation
 ≤ 0.3 dB for 10mm separation

PRODUCT DESCRIPTION:

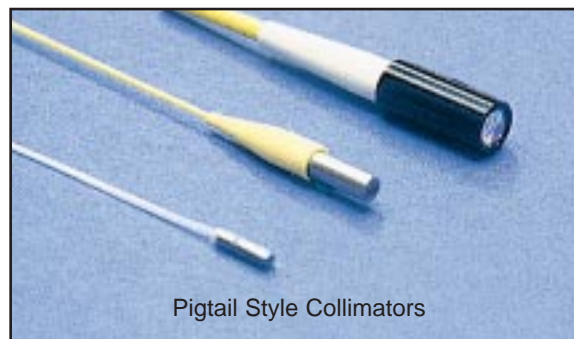
OZ Optics offers a complete line of fiber collimators and focusers with low backreflection, designed to collimate or focus light exiting a fiber to a desired beam diameter or spot size. By utilizing diffraction limited lenses, spot sizes of a few microns can be achieved. These devices can be used with laser diodes, photodiodes, acousto-optic modulators and other fiber optic devices. Collimators and focusers can be used as matched pairs to couple light in and out of optical devices. This makes them ideal for fiber packaging of devices.

For collimators, the collimated beam diameter (**BD**) and full divergence angle (**DA**) depends upon the focal length of the lens (**f**), the core diameter (**a**), and the fiber numerical aperture (**NA**). The collimated beam characteristics are given by:

$$\text{BD}(\text{mm}) = 2 \times f(\text{mm}) \times \text{NA} \quad \text{DA}(\text{mrad}) = a(\mu\text{m}) / f(\text{mm})$$



Receptacle Style Collimators



Pigtail Style Collimators

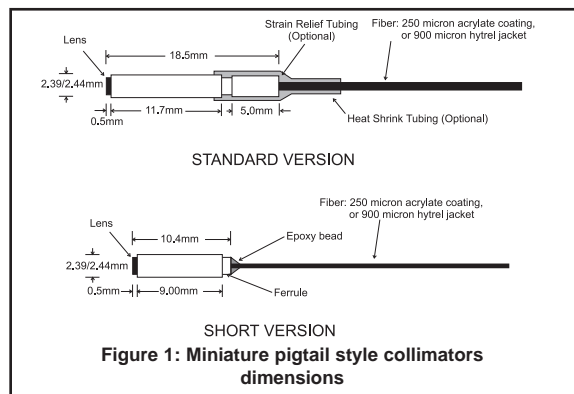


Figure 1: Miniature pigtail style collimators dimensions

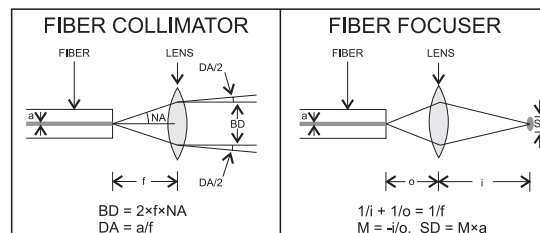


Figure 2: Operating Principle

When using the above formulae, please exercise caution. Different definitions for the numerical aperture are used by fiber manufacturers. For instance, definitions based on 50 percent, 13.5 percent ($1/e^2$), 5 percent, and 1 percent intensity levels are all used.

Oz Optics standard tables list the definitions used for each fiber type, as well as conversion factors to convert values to $1/e^2$ values. Oz Optics uses $1/e^2$ definitions for its calculations of the beam diameter wherever possible.

For fiber focusers, the exact calculation of the spot diameter (**SD**), magnification factor (**M**), and working distance (**WD**) is more difficult and depends on the

properties of the lenses being used. As a first approximation, one can calculate the desired focuser characteristics using the geometric optics lens formulae:

$$\frac{1}{i} + \frac{1}{o} = \frac{1}{f} \quad M = -\frac{i}{o}$$

$$SD = M \times a \quad WD \cong i$$

Where **o**, **i** are the object and image distances respectively. Use the above formulae to determine what focal lens you require. Standard focal lengths and lenses are listed in the Standard Tables data sheet.

TEST RESULTS:

The following tests were conducted on a pigtail style collimator pair attached to a fixture providing a separation of 60mm. The pair was adjusted for maximum coupling efficiency.

- Temperature Range:** Operating: -15°C to 55°C with 0.2dB deviation in loss.
Storage: -45°C to +75°C with less than 0.05dB residual loss.
- Humidity Test:** 97% humidity for 48 hours with 0.2dB deviation and less than 0.05dB residual loss (with the gap between the collimating lenses sealed against the environment).
- Vibration and Shock Test:** Vibration tests were performed, consisting of a 0.05 inch peak to peak displacement, sweeping from 10 to 55 Hz over 15 minutes dwell at worst resonance of 55 Hz (.02g). Each device was tested for twenty-five minutes per axis for a total of 75 minutes of vibration. Tests were conducted in each of the three major axes of the test unit. Shock tests consisting on 100g, 11 msec duration half-sine shocks, three times on each face for a total of 18 shocks, were also performed. Coupling loss deviation was 0.05dB with no hysteresis.

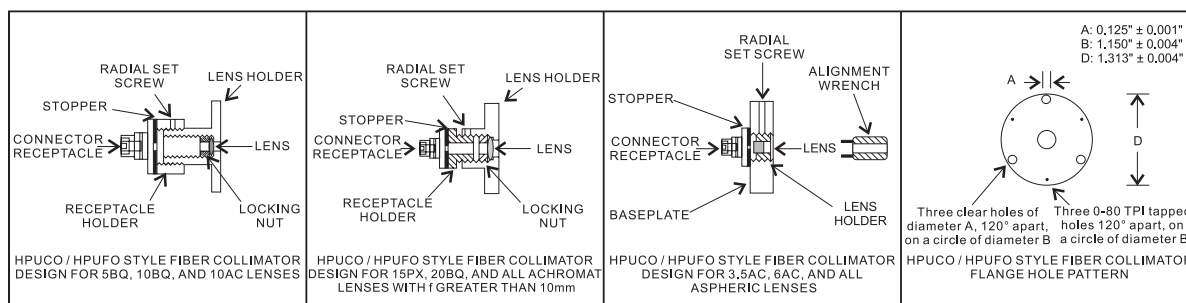


Figure 3: HPUCO/HPUFO receptacle style collimator/focuser assembly

TABLE 9: STANDARD ACHROMATIC LENSES

Part Number (f)	Focal Length (mm)	Diameter (mm)	Standard Wavelengths (nm)	Backreflection (dB)	Suitable Collimators and Focusers
3.5AC	3.5	2	400-700	-25, -40	LPC-01, LPC-02, LPC-03, LPF-01, LPF-02, LPF-03, HPUCO-2X, HPUFO-2X
6AC	6	3	400-700	-25, -40	LPC-01, LPC-02, LPC-03, LPF-01, LPF-02, LPF-03, HPUCO-2X, HPUFO-2X
6.3AG [†]	6.3	2	400-700	-25, -40	HPUCO-2X, HPUFO-2X
10AC	10	6	400-1550	-25, -40	LPC-02, LPC-03, LPC-04, LPF-02, LPF-03, LPF-04, HPUCO-2X, HPUFO-2X
16AC	16	8	400-700	-25, -40	HPUCO-2X, HPUFO-2X
20AC	20	10	400-1550	-25, -40	HPUCO-2X, HPUFO-2X
25AC	25	12.5	400-1550	-25, -40	HPUCO-2X, HPUFO-2X
30AC	30	12.5	400-1550	-25, -40	HPUCO-2X, HPUFO-2X
35AC	35	12.5	400-1550	-25, -40	HPUCO-2X, HPUFO-2X
44AC	44	14	400-1550	-25, -40	HPUCO-2X, HPUFO-2X
50AC	50	20	400-1550	-25, -40	HPUCO-2X, HPUFO-2X

[†] 6.3AG is an airgap achromatic lens for high power applications. Consult OZ Optics for other available lenses.

TABLE 10: STANDARD GRIN LENSES

Part Number (f)	Focal Length (mm)	Diameter (mm)	Standard Wavelengths (nm)	Backreflection (dB)	Suitable Collimators and Focusers
1GR	1.0	1.0	1300-1550	-25	LPC-01, LPC-02, LPC-03, LPC-05
1.01GR	1.0	1.0	1300-1550	-25, -40	LPC-01, LPC-02, LPC-03, LPC-05, LPF-01, LPF-02, LPF-03, LPF-05
1.8GR	1.8	1.8	660±30, 810±40, 1060±40, 1300-1550	-25	LPC-01, LPC-02, LPC-03, LPC-05, HUCO-2X, HUCO-3X
1.81GR	1.8	1.8	400-1600	-25, -40, -55†‡	LPF-01, LPF-02, LPF-03, LPF-05, LPF-01, LPF-02, LPF-03, LPF-05
1.9GR	1.9	1.8	400-1600	-25, -40, -55†‡	LPF-01, LPF-02, LPF-03, LPF-05, HPUFO-2X
2.13GR	2.13	1.8	1300-1550	-25, -40, -60	LPC-01, LPC-02, LPC-03, LPC-05, LPF-01, LPF-02, LPF-03, LPF-05
2.6GR	2.6	2.0	660±30, 810±40, 1060±40, 1300-1550	-25	LPC-01, LPC-02, LPC-03, LPC-05 HUCO-2X, HUCO-3X
2.61GR	2.6	2.0	400-1600	-25, -40	LPC-01, LPC-02, LPC-03, LPC-05 LPF-01, LPF-02, LPF-03, LPF-05, HPUFO-2X
3GR	3.0	3.0	660±30, 810±40	-25	LPC-01, LPC-02, LPC-03
3.2GR	3.2	3.0	400-1600	-25, -40	LPC-01, LPC-02, LPC-03, LPF-01, LPF-02, LPF-03, HPUFO-2X
4.7GR	4.7	3.0	400-1600	-25, -40	LPC-01, LPC-02, LPC-03, LPF-01, LPF-02, LPF-03, HPUFO-2X
6.6GR	6.6	4.0	400-1600	-25, -40	LPC-02, LPC-03, LPC-04, LPF-02, LPF-03, LPF-04, HPUFO-2X
18AGR†	18	10	400-1600	-25, -40	HPUCO-2X, HPUFO-2X
30AGR†	30	10	400-1600	-25, -40	HPUCO-2X, HPUFO-2X
50AGR†	50	20	400-1600	-25, -40	HPUCO-2X, HPUFO-2X

† AGR denotes axial grin lenses.

‡ -55dB is standard for 1300 and 1550nm only. Consult OZ Optics for availability at other wavelengths.

TABLE 11: STANDARD ASPHERIC LENSES

Part Number (f)	Focal Length (mm)	Diameter (mm)	Standard Wavelengths (nm)	Backreflection (dB)	Suitable Collimators and Focusers
2AS	2.0	2.0	375-1600	-25, -40, -60†	LPC-01, LPC-02, LPC-03, LPF-01, LPF-02, LPF-03, HPUCO-2X, HPUFO-2X
2.7AS	2.7	3.0	375-1600	-25, -40, -60†	LPC-02, LPC-03, LPC-04, LPF-02, LPF-03, LPF-04, HPUCO-2X, HPUFO-2X
3.9AS	3.9	4.3	375-1600	-25, -40, -60†	LPC-02, LPC-03, LPC-04, LPF-02, LPF-03, LPF-04, HPUCO-2X, HPUFO-2X
6.2AS	6.2	5.0	375-1600	-25, -40, -60†	LPC-02, LPC-03, LPC-04, LPF-02, LPF-03, LPF-04, HPUCO-2X, HPUFO-2X
11AS	11.0	5.5	375-1600	-25, -40, -60†	LPC-02, LPC-03, LPC-04, LPF-02, LPF-03, LPF-04, HPUCO-2X, HPUFO-2X

† -60dB backreflection is standard for 1300nm and 1550nm wavelengths only. Consult OZ Optics for availability at other wavelengths.

TABLE 12: STANDARD PLANO-CONVEX AND BICONVEX LENSES

Part Number (f)	Focal Length (mm)	Diameter (mm)	Standard Wavelengths (nm)	Backreflection (dB)	Suitable Collimators and Focusers
5BQ	5	6	180-700, 1064±50	-25, -40, -60	LPC-02, LPC-03, LPC-04, LPF-02, LPF-03, LPF-04, HPUCO-2X, HPUFO-2X
10BQ	10	10	180-700, 1064±50	-25, -40, -60	HPUCO-2X, HPUFO-2X
15PX	15	10	400-700, 1064±50	-25, -40, -60	HPUCO-2X, HPUFO-2X
25PQ	25	12.5	180-700, 1064±50	-25, -40, -60	HPUCO-2X, HPUFO-2X

ORDERING INFORMATION:

Receptacle Style Collimator: **HUCO-AX-W-F-f**

Receptacle Style Focuser: **HPUFO-AX-W-F-M-WD-f**

Collimator Type:

- HUCO = Contact Style (GRIN lens only)
- HPUFO = Non-Contact Style (All other lens types)

Flange Diameter: 2 for 1.3" OD flange
3 for 0.79" OD flange

Receptacle Code: 3 = NTT-FC/PC
3S = Super NTT-FC/PC
3U = Ultra NTT-FC/PC
3A = Angled NTT-FC/PC
5 = SMA905 & 906
8 = AT&T-ST
SC = SC
SCA = Angled SC

See Table 6 of the Standard Tables data sheet for other receptacles

Lens Type: See Tables 9 to 12 of the Standard Tables data sheet

Working Distance in mm

Magnification factor

Fiber Type: M = Multimode
S = Singlemode
P = Polarization maintaining

Wavelength: Specify in nanometers (Example: 1550 for 1550nm)

Pigtail Style Collimator: **LPC-0A-W-a/b-F-BD-f-BL-X-JD-L**

Pigtail Style Focuser: **LPF-0A-W-a/b-F-M-WD-f-BL-X-JD-L**

Collimator 1 for 4.0mm OD, no flange
Diameters: 2 for 33mm OD removable flange*
3 for 20mm OD removable flange*
4 for 8.0mm OD removable flange*
5 for 2.5mm OD, standard length
6 for 2.5mm OD, short length†

Wavelength: Specify in nanometers (Example: 1550 for 1550nm)

Fiber core/cladding sizes in microns
9/125 for 1300/1550nm singlemode fiber.
See Tables 1 to 5 for other standard fiber sizes

Fiber Type: M = Multimode
S = Singlemode
P = Polarization maintaining

Magnification factor

Working Distance in mm

Fiber length, in meters

Fiber Jacket 0.25 = 250 Micron OD acrylate jacket
Type: 1 = 900 Micron OD hytel jacket
3 = 3mm OD Kevlar reinforced PVC cable

See Table 7 of the Standard Tables data sheet for other jacket sizes

Connector Code: 3 = NTT-FC/PC
3S = Super NTT-FC/PC
3U = Ultra NTT-FC/PC
3A = Angled NTT-FC/PC
5 = SMA905
6 = SMA906
8 = AT&T-ST
SC = SC
SCA = Angled SC

See Table 6 of the Standard Tables data sheet for other connectors

Backreflection level: 25, 40, 50, or 60dB.

60dB version available for 1300nm and 1550nm only

Lens focal length and type: See Tables 9 to 12

*Smaller diameter removable flanges (11.5mm to 15mm diameters) are available on request.

† 2.5mm OD short length collimators are available with 0.25mm, or 0.9mm OD jacketed fibers.

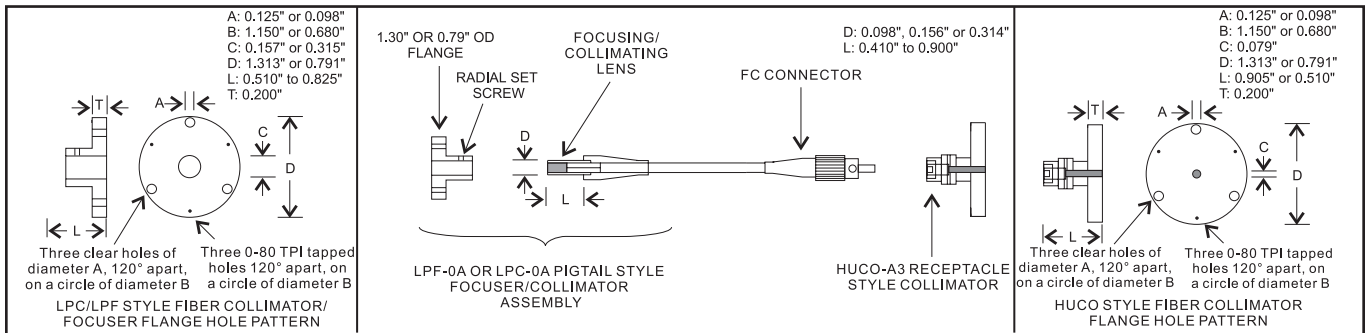


Figure 4: LPC Pigtail style and HUCO receptacle style fiber collimator/focuser assembly