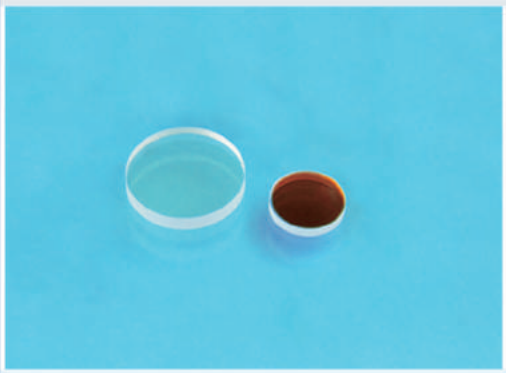
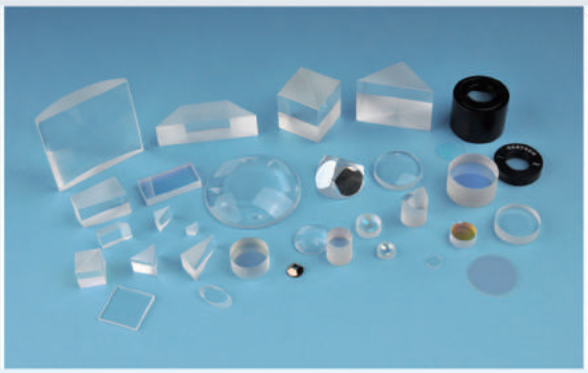
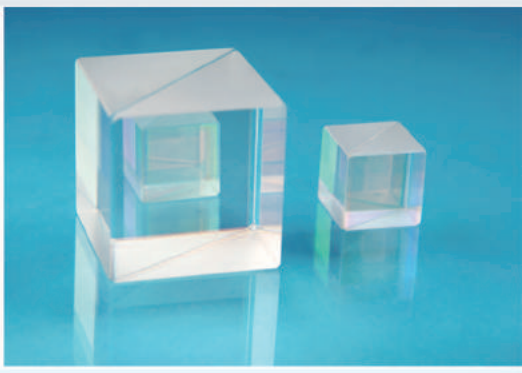
CASTECH®
福晶科技

OPTICS CATALOGUE

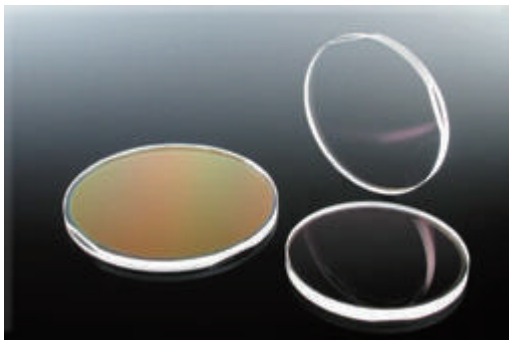
(2017-2018)

GWU-Lasertechnik

福建福晶科技股份有限公司
CASTECH INC.

Waveplates



Principle of Waveplate

Waveplates (retardation plates or phase shifters) are made from material which exhibit birefringence. The velocities of the extraordinary and ordinary rays through the birefringent material vary inversely with their refractive indices. The difference in velocities gives rise to a phase difference when the two beams recombine. In the case of an incident linearly polarized beam this is given by

$$\delta = \frac{2 \cdot \pi \cdot (ne - no)}{\lambda} \cdot d$$

where:

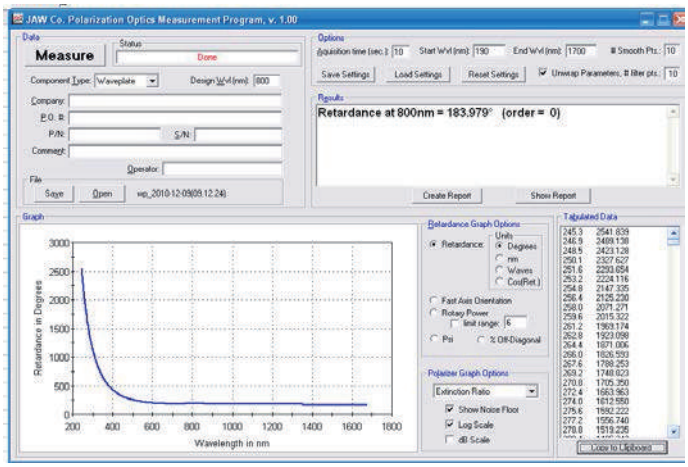
δ -phase difference;

d -thickness;

ne , no -refractive index of extraordinary and ordinary rays;

λ -wavelength.

At any specific wavelength, the phase difference is given by the thickness of the retarder.



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Half Waveplate

Half waveplate can be used to rotate the polarization state of a plane polarized light as shown in Figure 1.

Suppose a plane-polarized wave is normally incident on a waveplate, and the plane of polarization is at an angle θ with respect to the fast axis, as shown. After passing through the plate, the original plane wave has been rotated through an angle 2 θ.

A half-wave plate is very handy in rotating the plane of polarization from a polarized laser to any other desired plane (especially if the laser is too large to rotate). Most large ion lasers are vertically polarized. To obtain horizontal polarization, simply place a half-wave plate in the beam with its fast (or slow) axis 45° to the vertical. The λ/2 plates can also change left circularly polarized light into right circularly polarized light or vice versa.

The thickness of the half waveplate is such that the phase difference is 1/2 wavelength (λ/2, True Zero order) or certain multiple of 1/2 wavelength [(2n+1) λ/2], multiple order).

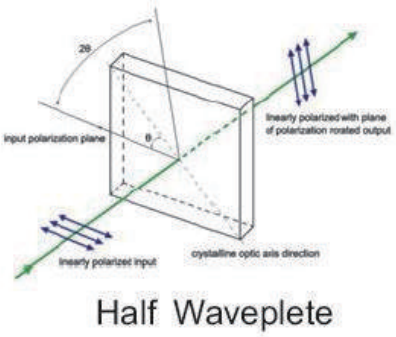


Figure 1

Quarter Waveplate

Quarter wave plate are used to turn plane-polarized light into circularly polarized light or vice versa. To do this, we must orient the wave plate so that equal amounts of fast and slow waves are excited. We may do this by orienting an incident plane-polarized wave at 45° to the fast (or slow) axis, as shown in Figure 2. When a λ/4 plate is double passed, i.e., by mirror reflection, it acts as a λ/2 plate and rotates the plane of polarization to a certain angle, i.e., 90° . This scheme is widely used in isolators, Q-switches, etc.

The thickness of the quarter waveplate is such that the phase difference is 1/4 wavelength (λ/4. true Zero order) or certain multiple of 1/4 wavelength ([(2n+1) λ/4], multiple order).

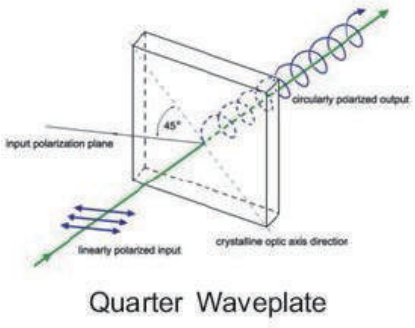


Figure 2

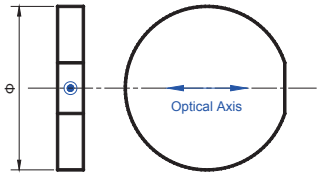
CASTECH provides many kinds of waveplates, such as Low- Order waveplate, Cemented Zero-Order waveplate, Airspaced Zero-Order waveplate, True Zero-Order waveplate , Dual wavelength waveplate *a*nd Telecom Wave Plates. Also we provide waveplates with different retardation as half-wave, quarter-wave, octadic-wave and full-wave. If you want to order the specific retardation of waveplate for your system, **CASTECH** is able to design any types of them for you.

High precision and mass production are available upon requirement for waveplates.

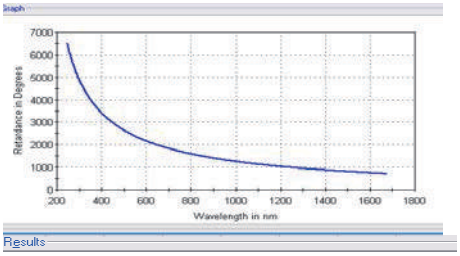
Multi-Order Waveplates

Specifications

Material:	Crystal Quartz
Diameter Tolerance:	+0/-0.25mm
Retardance Accuracy:	＜λ/300
Clear Aperture:	≥central 90% of diameter
Surface Quality:	20-10 scratch-dig
Wavefront Distortion:	λ/10@633 nm over the clear aperture
Parallelism:	≤3"
Coating:	Laser Line AR Coating R<0.25%
Damage Threshold:	2MW/cm² 2J/cm² with 10 nsec Pulse



- Wide Temperature Bandwidth.
- CASTECH's standard coatings are available
- Custom designs for other sizes and coatings are also available upon request.



Single Wavelength Waveplates

Order Information

WPL	—	254	—	1/4	—	W1064
Product Code		Φ=25.4mm		Retardation =λ/4		Design Wavelength "λ"=1064nm

Half Waveplate	Quarter Waveplate
WPL-127-1/2 –λ	WPL-127-1/4-λ
WPL-150-1/2-λ	WPL-150-1/4-λ
WPL-200-1/2-λ	WPL-200-1/4-λ
WPL-254-1/2 -λ	WPL-254-1/4-λ

Standard Wavelength (λ)

Wavelength	Wavelength	Wavelength	Wavelength	Wavelength	Wavelength
248 nm	413 nm	514.5 nm	632.8 nm	800 nm	1064 nm
266 nm	441.6 nm	532 nm	647.1 nm	830 nm	1300 nm
308 nm	457.9 nm	543.5 nm	676.4 nm	850 nm	1315 nm
351 nm	488 nm	594 nm	694.3 nm	905 nm	1320 nm
354.7 nm	510.5 nm	611.9 nm	780 nm	1050 nm	1550 nm

Dual Wavelength Waveplates

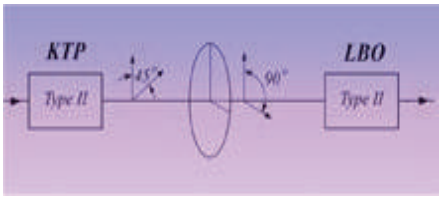
Dual wavelength waveplate is widely used on Third Harmonic Generation (THG) system. When you need a NLO crystal for type II SHG (o+e→e), and a NLO crystal for type II THG (o+e→e), the out put polarization from SHG can not be used for THG. So you must turn the polarization to get two perpendicular polarization for type II THG. Dual wavelength waveplate works like a polarizing rotator, it can rotate the polarization of one beam and remain another beam's polarization. Also the dual wavelength waveplate can be applied to following systems:

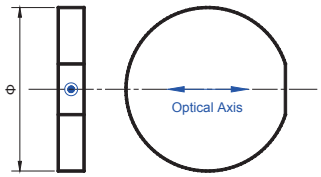
1. **Type II SHG + Type II THG**
2. **Type II SHG + Type I THG**
3. **Type I SHG + Type I THG**

For example: we use KTP as SHG type II and LBO as THG type II, but the polarization of output beam from KTP is not optimized for THG type II. When we use a dual wavelength waveplate as drawing, it can change the 532nm beam to a special angle polarization but not change 1064nm beam at all.

Specifications

Material:	Crystal Quartz
Diameter Tolerance:	+0/-0.25mm
Retardance Accuracy:	＜λ/100
Clear Aperture:	≥central 90% of diameter
Surface Quality:	20-10 scratch-dig
Wavefront Distortion :	λ/10@633 nm over the clear aperture
Parallelism:	≤3"
Coating:	Laser Line V AR Coating R<0.25%
Damage Threshold:	2MW/cm² 2J/cm² with 10 nsec Pulse





Order Information:

WPD	—	127	—	1/2	—	1/4	—	W1064	—	W532
Product Code		Φ=12.7mm		Retardation 1=λ/2		Retardation 2=λ/4		Wavelength 1=1064nm		Wavelength2=532nm

Standard Retardation

Wavelength 1-Wavelength 2	W1064-W532 (nm)	W1064-W355 (nm)	W532-W266 (nm)	W532-W355 (nm)
Retardation 1-Retardation 2	λ-λ/2	λ/2-λ	λ/4-λ/2	λ/2-λ/4

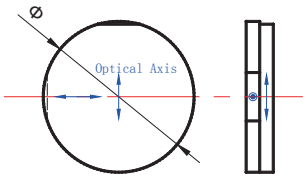
Note :

- Custom designs for other sizes ,coatings and holders are also available upon request.
- CASTECH's standard coatings are available upon request.

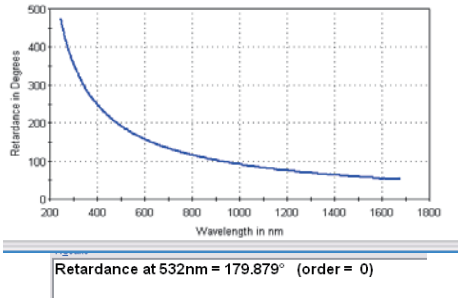
Optically Contacted Zero-Order Waveplates

Specifications

Material:	Crystal Quartz
Diameter Tolerance:	+0/-0.25mm
Retardance accuracy:	＜λ /300
Clear Aperture:	≥ central 90% of diameter
Surface Quality:	20-10 scratch - dig
Wavefront Distortion :	λ/10@632.8 nm over the clear aperture
Parallelism:	≤3″
Coating:	R<0.25% at design wavelength
Damage Threshold:	2MW/cm^2 2J/cm^2 with 10 nsec



- High Damage Threshold
- Wide Temperature Bandwidth
- Broad Spectral Bandwidth



Order Information

WPZO	—	127	—	1/2	—	W266
Product Code		Φ =12.7 mm		Retardation=λ/2		Design Wavelength “λ”=266nm

Optically Contacted Zero-Order Waveplates

Half Waveplate	Quarter Waveplate
WPZO-100-1/2-λ	WPZO-100-1/4-λ
WPZO-127-1/2-λ	WPZO-127-1/4-λ
WPZO-200-1/2-λ	WPZO-200-1/4-λ
WPZO-254-1/2-λ	WPZO-254-1/4-λ

Standard Wavelength (λ)

- **Please see page 39**

Note:

- Custom designs for other sizes ,coatings and holders are also available upon request.
- CASTECH’s standard coatings are available.

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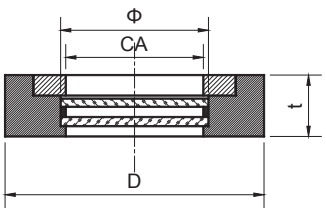
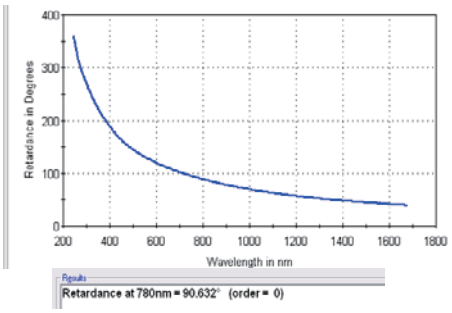
Air Spaced Zero-Order Waveplates

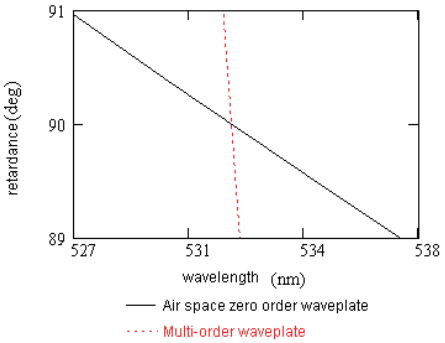
Specifications

Material:	Crystal Quartz
Diameter Tolerance:	+0/-0.25mm
Retardance accuracy:	＜λ/300
Clear Aperture:	≥ central 90% of diameter
Surface Quality:	20-10 scratch - dig
Wavefront Distortion:	λ/10@632.8 nm over the clear aperture
Parallelism:	≤3"
AR Coating:	R<0.25% per surface at design wavelength
Damage Threshold:	2MW/cm² 2J/cm² with 10 nsec



- High Damage Threshold
- Wide Temperature Bandwidth
- Broad Spectral Bandwidth
- CASTECH's standard coatings are available
- Custom designs for other sizes and coatings are also available upon request





Order Information

WPZA	—	127	—	1/2	—	W266
Product Code		Φ =12.7 mm		Retardation=λ/2		Design Wavelength "λ"=266nm

Air Spaced Zero-Order Waveplates

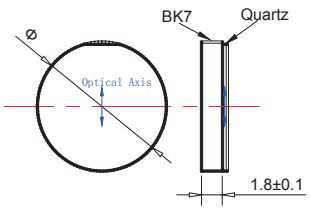
Half Waveplate	Quarter Waveplate
WPZA-100-1/2-λ	WPZA-100-1/4-λ
WPZA-127-1/2-λ	WPZA-127-1/4-λ
WPZA-200-1/2-λ	WPZA-200-1/4-λ
WPZA-254-1/2-λ	WPZA-254-1/4-λ

- Standard Wavelength ,please see page 39.
- Standard Mounts and Holders ,please see page 48.

True Cemented Zero-Order Waveplates

Specifications

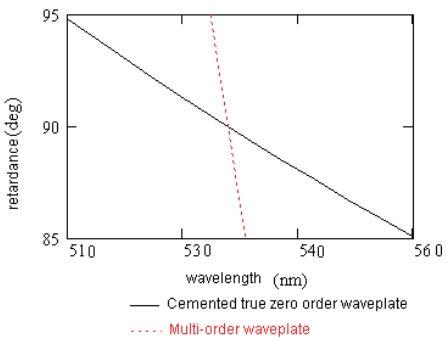
Material:	Crystal Quartz
Substrate Material:	BK7
Diameter Tolerance:	+0/-0.2mm
Clear Aperture:	≥ central 90% of diameter
Retardance Accuracy:	＜ λ /300
Surface Quality:	20-10 scratch - dig
Wavefront Distortion	λ/8@632.8 nm over the clear aperture
Parallelism:	≤10"
AR Coating:	R<0.25% at design wavelength
Damage Threshold	500W/cm² 4J/cm² with 20 nsec

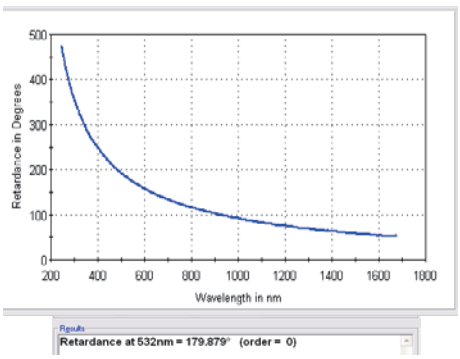


Order Information

WPCT — 127 — 1/4 — W532

Product Code | Φ =12.7 mm | Retardation=λ/4 | Design Wavelength "λ"=532nm





Cemented True Zero-Order Waveplates

Half Waveplate	Quarter Waveplate
WPCT-100-1/2-λ	WPCT-100-1/4-λ
WPCT-127-1/2-λ	WPCT-127-1/4-λ
WPCT-200-1/2-λ	WPCT-200-1/4-λ
WPCT-254-1/2-λ	WPCT-254-1/4-λ

Note:

- Custom designs for other sizes and coatings are also available upon request.
- CASTECH's standard coatings are available.

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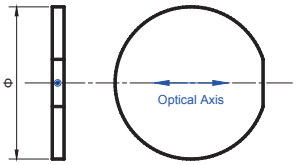
True Zero-Order Waveplates

Specifications

Material:	Crystal Quartz
Diameter Tolerance:	+0/-0.2mm
Retardance Accuracy:	＜λ/300
Clear Aperture:	≥ central 90% of diameter
Surface Quality:	20-10 scratch - dig
Wavefront Distortion :	λ/8@632.8 nm over the clear aperture
Parallelism:	≤10”
Coating:	R<0.25% per surface at design wavelength
Damage Threshold:	500W/cm^2 4J/cm^2 with 20 nsec

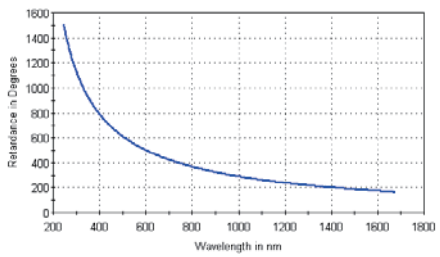


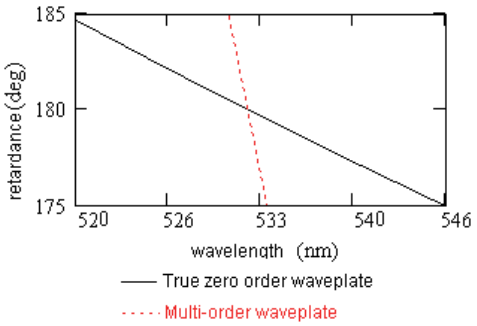
Order Information

WPT	—	127	—	1/4	—	W532
Product Code		Φ =12.7 mm		Retardation=λ/4		Design Wavelength” λ”=532nm

True Zero-Order Waveplates

Half Waveplate	Quarter Waveplate
WPT-100-1/2-λ	WPT-100-1/4-λ
WPT-127-1/2-λ	WPT-127-1/4-λ
WPT-200-1/2-λ	WPT-200-1/4-λ
WPT-254-1/2-λ	WPT-254-1/4-λ





Note:

- Custom designs for other sizes, coatings and holder are also available upon request.
- CASTECH’s standard coatings are available.

Achromatic Zero-Order Waveplates

Achromatic Zero-Order waveplate is made from two different substrate Material such as crystal quartz and magnesium fluoride. For the single material waveplates the working wavelength is very limited because of the dispersion of the material. While Achromatic Zero-Order Waveplate use two different kinds of material, the dispersions of the birefringence are also different. Hence such waveplate is not sensitive to the wavelength change.

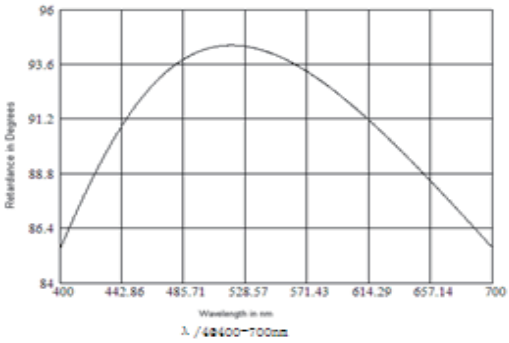
CASTECH design Achromatic Zero-Order Quartz-MgF2 waveplates with working wavelength range larger than 300nm and retardation accuracy better than λ/50 for λ/2 waveplate and better than λ/100 for λ/4 waveplate.

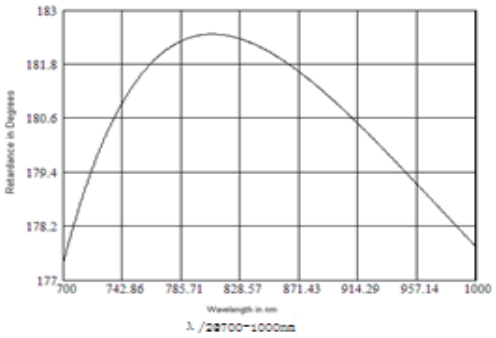
Main advantages:

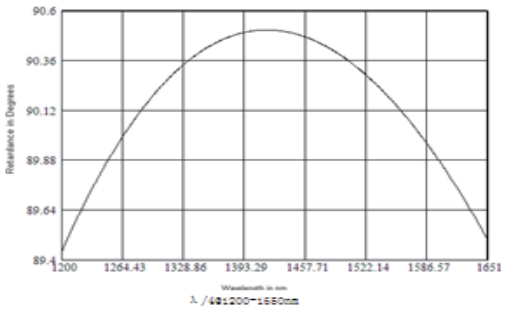
- Extremely broad wavelength ranges
- High damage threshold for Air-spaced Achromatic Zero-Order waveplate
- Low sensitivity within the designed wavelength
- Retardation tolerance up to λ /100 over the wavelength range

CASTECH can offer two kinds of Achromatic Zero-Order Waveplates:

Air Spaced and Optically Contacted Achromatic Zero-Order Waveplates







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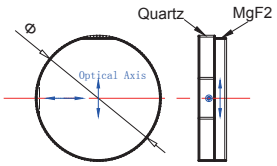
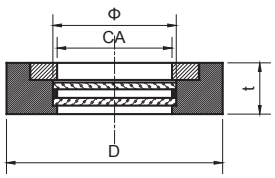
Achromatic Zero-Order Waveplates

Specifications

Material:	Crystal Quartz and Magnesium Fluoride
Diameter Tolerance:	+0/-0.2mm
Retardance Accuracy:	better than λ/50 for λ/2 achromatic waveplates better than λ/100 for λ/4 achromatic waveplates
Clear Aperture:	≥ central 90% of diameter
Surface Quality:	40/20 scratch / dig
Wavefront Distortion:	λ/4@632.8 nm over the clear aperture
Parallelism:	≤10"
Coating:	AR coating at design wavelength
Damage Threshold:	500W/cm² 4J/cm² with 20 nsec



Optically Contacted
Achromatic Zero-Order Waveplate



Air-Spaced
Achromatic Zero-Order Waveplate

Order Information

WPAO	—	127	—	1/4	—	W400-700
Product Code		Φ =12.7 mm		Retardation= λ/4		Design Wavelength "λ"=400-700nm

Achromatic Zero-Order Waveplates

Optically Contacted Achromatic Zero-Order Waveplate		Air-Spaced Achromatic Zero-Order Waveplate	
Half Achromatic Waveplate	**Quarter Achromatic Waveplate**	**Half Achromatic Waveplate**	**Quarter Achromatic Waveplate**
WPAO-127-1/2-λ	WPAO-127-1/4-λ	WPAA-127-1/2-λ	WPAA-127-1/4-λ
WPAO-150-1/2-λ	WPAO-150-1/4-λ	WPAA-150-1/2-λ	WPAA-150-1/4-λ
WPAO-200-1/2-λ	WPAO-200-1/4-λ	WPAA-200-1/2-λ	WPAA-200-1/4-λ
WPAO-254-1/2-λ	WPAO-254-1/4-λ	WPAA-254-1/2-λ	WPAA-254-1/4-λ

Standard Wavelength Ranges(λ)

400-700 nm	700-1000 nm	1200-1650 nm

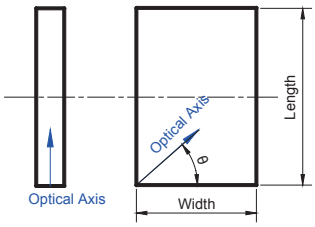
Note:

- Custom designs for other sizes and coatings are also available upon request.
- CASTECH's standard coatings are available.
- Other waveplates with different wavelength range (between 400-2100nm) are also available upon request, please contact CAETECH for more information.

Telecom Waveplates

Specifications

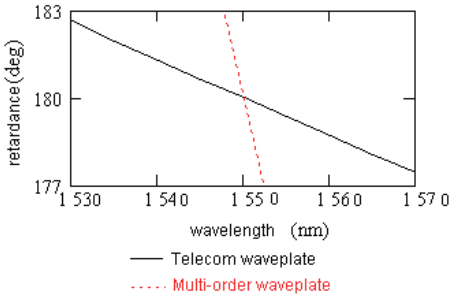
Material:	Crystal Quartz
Diameter Tolerance:	+0/-0.1mm
Design Wavelength:	1550nm
Retardance Accuracy:	better than λ/300@1550nm
Surface Quality:	40/20 scratch / dig
Wavefront Distortion :	λ/4@632.8 nm over the full aperture
Parallelism:	≤3"
AR Coating:	Both surfaces R < 0.25% @ 1525 – 1565 nm
Damage Threshold:	500W/cm² 4J/cm² with 20 nsec



Telecom Waveplates

Order Information

WPT	–	040	–	030	–	1/4	–	W1550
Product Code		Length=4.0 mm		Width=3.0mm		Retardation= λ/4		Design Wavelength "λ"=1550nm



Types:

"1/4" means Quarter Waveplate

"1/2" means Half Waveplate

Also, please provide the angle θ.

Telecom waveplates are designed and manufactured specifically to meet the demanding requirements of telecom component designers.

CASTECH provides telecom waveplate with many kinds of sizes , they are 91.5μm thick for the half-waveplate and 45.7μm thick for the quarter-waveplate at 1550nm. The telecom waveplates are AR coated from 1525nm to 1565nm in order to minimize surface reflection losses.

Standard Telecom Waveplates

size	Design Wavelength	AR Coating	Retardation
Kinds of size	1550 nm	R < 0.25% @ 1525 – 1565 nm	λ/4 or λ/2

Note:

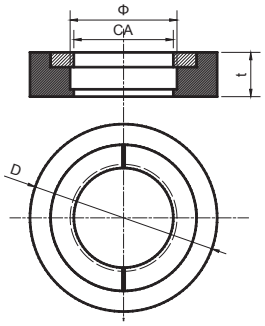
- Custom designs for other specifications and coating are also available upon request.

Tel:+86-591-83710533 E-mail:sales@castech.com http://www.castech.com

Mounts and Holders for Waveplates

Ring Mount

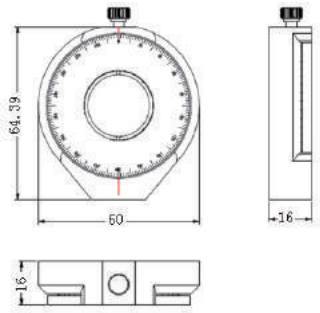
Material and finished:	Black anodized aluminum
Outside Diameter(D) Tolerance:	± 0.1mm
Thickness (t) Tolerance:	± 0.1mm
Waveplate Diameter (Ø) Tolerance:	+0.15,-0.0mm



Part No.	D (mm)	Ø (mm)	Clear Aperture (mm)	Thickness (mm)
RM-01	25.4	10.0	9.0	6.0
RM-02	25.4	12.7	11.5	6.0
RM-03	25.4	15.0	13.5	6.0
RM-04	30.0	20.0	18.0	6.0
RM-05	30.0	25.4	22.8	6.0

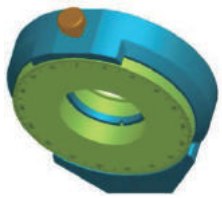
Rotating Holder

Material and finished:	Black anodized aluminum
Rotation Accuracy:	1°
Dimension Tolerance:	± 0.1mm



Order Information

Part No.	Outside Dimension (mm)			Installation Dimension (mm)		Matched Screw Diameter (mm)
	Matched Screw Diameter	Height	Length	Diameter	Thickness	
RH-01	64.39	60.0	16.0	25.4	6.0	6.35
RH-02	64.39	60.0	16.0	30.0	6.0	6.35



- Custom designs for other sizes of mount are also available.

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