



# Sapphire viewports with Anti-Reflective Coatings

Sapphire viewports with Anti-Reflective Coatings

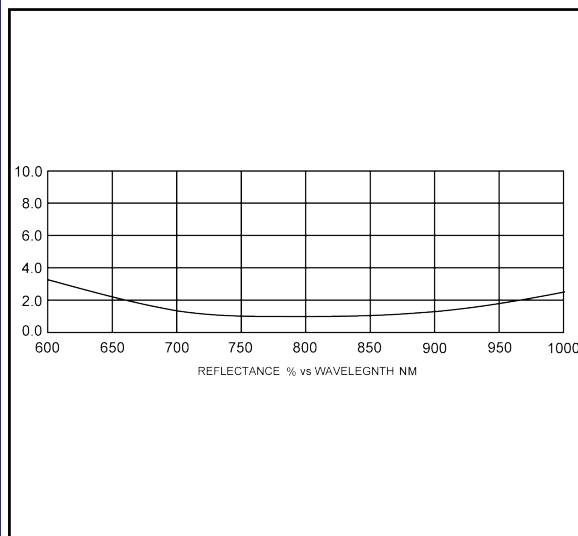


Specification	
Seal Type	Braze
Maximum Temperature	200°C (KF & ISO versions 150°C)
Minimum Temperature	minus 20°C
Maximum Rate of Temperature Change	3°C per minute
Leak Rate	<1x10 <sup>-10</sup> atm-cc/sec (He)
Pressure Range	1 bar to 1x10 <sup>-11</sup> mbar
Surface Quality	60 /40 scratch/dig
Flatness	< 8λ
Coating	Single layer 1 x QWOT 'AR' coating optimised to customer specified wavelength range between 190nm and 1550nm

Torr Scientific Sapphire viewports are offered with a single 1 x QWOT MgF<sub>2</sub> layer anti-reflective (AR) coating on both sides of the window optimised to a customer specified wavelength range. Please advise the important wavelengths or wavelength range with your enquiry or order. Wavelength ranges between 190nm and 1550nm can be accepted as standard, although coatings for other wavelength ranges can be quoted on request. Viewports with 'V' coatings for a single wavelength applications and four-layer broadband low reflectance 'BBAR' coatings are also offered. Torr Scientific sapphire viewports are offered in CF, ISO and KF flange styles. The viewports comprise a high quality optic with precise flatness, parallelism, scratch and dig specifications. The single crystal sapphire windows have excellent optical, physical and chemical properties. The hardest of the oxide crystals, sapphire retains its high strength at high temperatures. Sapphire has a low coefficient of thermal expansion and low fluorescence, good resistance to thermal shock and scratching making this an excellent material for IR transmitting optics and robust applications. C-cut sapphire is selected for Torr Scientific sapphire viewports to minimise the effects of birefringence. The ultra high vacuum (UHV) CF versions are offered using high grade 304L or 316LN stainless steel flanges. Non-magnetic viewports are offered for low energy applications or surface science applications needing low magnetic fields. The non-magnetic viewports use a tantalum weld ring instead of the regular kovar weld ring. Flanges in 316L stainless steel are used for the high vacuum KF and ISO viewports. TSL viewports are manufactured in cleanroom conditions and helium leak tested, cleaned and packed to UHV standards. The rugged construction of the sapphire viewports allows repeated bake-out to 200°C with UHV performance, whilst the window offers broadband optical transmission through vacuum UV, visible to near infra-red. Non-standard viewports can be manufactured on request, including re-entrant style microscope/camera viewports. Annealed copper gaskets and other component accessories are also supplied by TSL.

## AR Reflection Curve - Sapphire

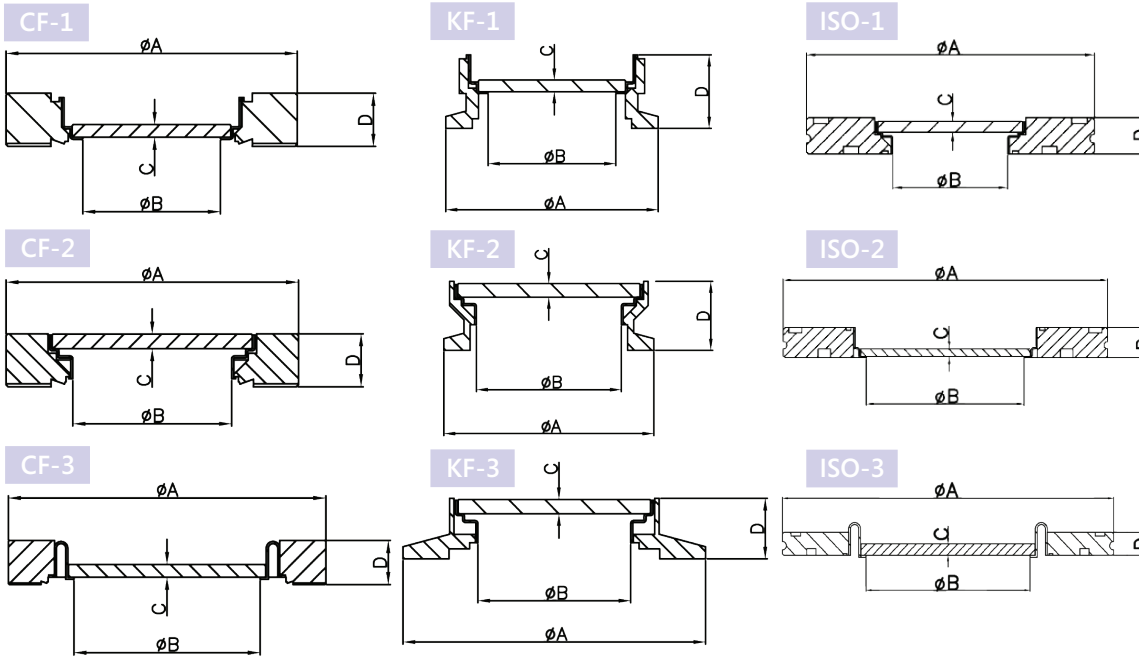
## The TSL UV-Vis Spectrophotometer



Please note that the optical reflectance curves are approximations and should be used for reference only



# Sapphire viewports with Anti-Reflective Coatings



Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring Material	Non-Magnetic
VPZ16S-200-AR	NW16CF	34	15	1.5	12.7	CF-1	304L	Kovar	
VPZ16S-200-AR-LN	NW16CF	34	15	1.5	12.7	CF-1	316LN	Kovar	
VPZ16S-200-AR-NM	NW16CF	34	15	1.5	12.7	CF-1	316LN	Tantalum	Yes
KVPZ16S-200-AR	KF16	25	15	1.5	12.7	KF-1	304L	Kovar	
KVPZ25S-200-AR	KF25	40	20	1.5	18.5	KF-2	304L	Kovar	
VPZ23S-200-AR	NW35CF	70	23	1.5	12.7	CF-1	304L	Kovar	
VPZ38S-200-AR	NW35CF	70	32	1.5	12.7	CF-3	304L	Kovar	
VPZ38LAS-200-AR	NW35CF	70	38	1.5	12.7	CF-2	304L	Kovar	
VPZ38S-200-AR-LN	NW35CF	70	32	1.5	12.7	CF-1	316LN	Kovar	
VPZ38LAS-200-AR-LN	NW35CF	70	38	1.5	12.7	CF-2	316LN	Kovar	
VPZ38S-200-AR-NM	NW35CF	70	32	1.5	12.7	CF-1	316LN	Tantalum	Yes
KVPZ40/32S-200-AR	KF40	55	32	1.5	12.7	KF-1	304L	Kovar	
KVPZ40S-200-AR	KF40	55	38	1.5	18.5	KF-3	304L	Kovar	
KVPZ50S-200-AR	KF50	75	38	1.5	15	KF-3	304L	Kovar	
VPZ64S-200-AR	NW63CF	114	63	2	17.4	CF-1	304L	Kovar	
VPZ64S-200-AR-LN	NW63CF	114	63	2	17.4	CF-1	316LN	Kovar	
VPZ64S-200-AR-NM	NW63CF	114	63	2	17.4	CF-1	316LN	Tantalum	Yes
ISO63SVPZ-200-AR	ISO63	95	38	1.5	12	ISO-1	304L	Kovar	
VPZ100S-200-AR	NW100CF	152	89	2.5	19.9	CF-3	304L	Kovar	
VPZ100S-200-AR-LN	NW100CF	152	89	2.5	19.9	CF-3	316LN	Kovar	
VPZ100S-200-AR-NM	NW100CF	152	89	2.5	19.9	CF-3	316LN	Tantalum	Yes
ISO100SVPZ-200-AR	ISO100	130	63	2	12	ISO-2	304L	Kovar	
VPZ150S-200-AR	NW150CF	203	136	4	22.3	CF-3	304L	Kovar	
VPZ150S-200-AR-LN	NW150CF	203	136	4	22.3	CF-3	316LN	Kovar	
VPZ150S-200-AR-NM	NW150CF	203	136	4	22.3	CF-3	316LN	Tantalum	Yes
ISO160SVPZ-200-AR	ISO160	180	89	2.5	12	ISO-3	304L	Kovar	
VPZ200S-200-AR	NW200CF	254	136	4	24.5	CF-3	304L	Kovar	

Sapphire viewports with Anti-Reflective Coatings



# Sapphire viewports with Broadband Anti-Reflective Coatings

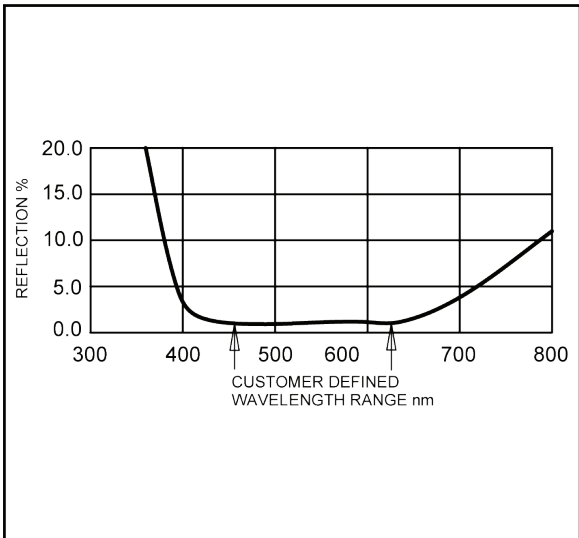
Sapphire viewports with Broadband Anti-Reflective Coatings



Specification	
Seal Type	Braze
Maximum Temperature	200°C (KF & ISO versions 150°C)
Minimum Temperature	minus 20°C
Maximum Rate of Temperature Change	3°C per minute
Leak Rate	<1x10 <sup>-10</sup> atm-cc/sec (He)
Pressure Range	1 bar to 1x10 <sup>-11</sup> mbar
Surface Quality	60 /40 scratch/dig
Flatness	< 8λ
Coating	4-layer BBAR coating optimised to customer specified wavelength range between 240nm and 1550nm

Torr Scientific Sapphire viewports are offered with a two-layer 'VAR' anti-reflective coating on both sides of the window optimised to a customer specified wavelength. The coating reduces reflection to below 0.5% per face or 1% total at the wavelength specified. Please advise the laser wavelength with your enquiry or order. Wavelengths between 240nm and 1550nm can be accepted as standard, although coatings for other wavelengths can be quoted on request. Viewports with coatings for a wavelength range can also be offered. Torr Scientific sapphire viewports are offered in CF, ISO and KF flange styles. The viewports comprise a high quality optic with precise flatness, parallelism, scratch and dig specifications. The single crystal sapphire windows have excellent optical, physical and chemical properties. The hardest of the oxide crystals, sapphire retains its high strength at high temperatures. Sapphire has a low coefficient of thermal expansion and low fluorescence, good resistance to thermal shock and scratching making this an excellent material for IR transmitting optics and robust applications. C-cut sapphire is selected for Torr Scientific sapphire viewports to minimise the effects of birefringence. The ultra high vacuum (UHV) CF versions are offered using high grade 304L or 316LN stainless steel flanges. Non-magnetic viewports are offered for low energy applications or surface science applications needing low magnetic fields. The non-magnetic viewports use a tantalum weld ring instead of the regular kovar weld ring. Flanges in 316L stainless steel are used for the high vacuum KF and ISO viewports. TSL viewports are manufactured in cleanroom conditions and helium leak tested, cleaned and packed to UHV standards. The rugged construction of the sapphire viewports allows repeated bake-out to 200°C with UHV performance, whilst the window offers broadband optical transmission through vacuum UV, visible to near infra-red. Non-standard viewports can be manufactured on request, including re-entrant style microscope/camera viewports. Annealed copper gaskets and other component accessories are also supplied by TSL.

## Reflectance Curve



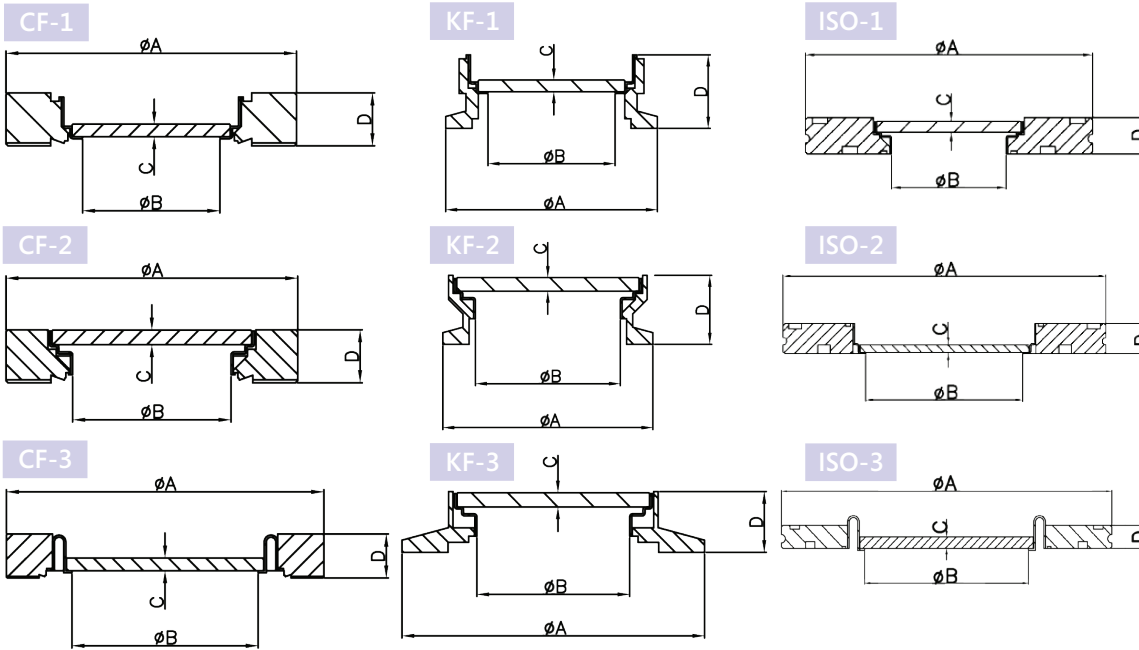
## The TSL UV-Vis Spectrophotometer



Please note that the optical reflectance curves are approximations and should be used for reference only



# Sapphire viewports with Broadband Anti-Reflective Coatings



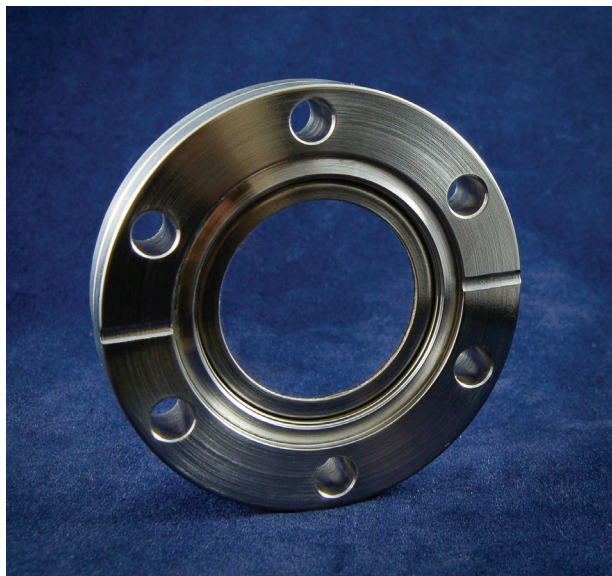
Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring Material	Non-Magnetic
VPZ16S-200-BBAR	NW16CF	34	15	1.5	12.7	CF-1	304L	Kovar	
VPZ16S-200-BBAR-LN	NW16CF	34	15	1.5	12.7	CF-1	316LN	Kovar	
VPZ16S-200-BBAR-NM	NW16CF	34	15	1.5	12.7	CF-1	316LN	Tantalum	Yes
KVPZ16S-200-BBAR	KF16	25	15	1.5	12.7	KF-1	304L	Kovar	
KVPZ25S-200-BBAR	KF25	40	20	1.5	18.5	KF-2	304L	Kovar	
VPZ23S-200-BBAR	NW35CF	70	23	1.5	12.7	CF-1	304L	Kovar	
VPZ38S-200-BBAR	NW35CF	70	32	1.5	12.7	CF-3	304L	Kovar	
VPZ38LAS-200-BBAR	NW35CF	70	38	1.5	12.7	CF-2	304L	Kovar	
VPZ38S-200-BBAR-LN	NW35CF	70	32	1.5	12.7	CF-1	316LN	Kovar	
VPZ38LAS-200-BBAR-LN	NW35CF	70	38	1.5	12.7	CF-2	316LN	Kovar	
VPZ38S-200-BBAR-NM	NW35CF	70	32	1.5	12.7	CF-1	316LN	Tantalum	Yes
KVPZ40/32S-200-BBAR	KF40	55	32	1.5	12.7	KF-1	304L	Kovar	
KVPZ40S-200-BBAR	KF40	55	38	1.5	18.5	KF-3	304L	Kovar	
KVPZ50S-200-BBAR	KF50	75	38	1.5	15	KF-3	304L	Kovar	
VPZ64S-200-BBAR	NW63CF	114	63	2	17.4	CF-1	304L	Kovar	
VPZ64S-200-BBAR-LN	NW63CF	114	63	2	17.4	CF-1	316LN	Kovar	
VPZ64S-200-BBAR-NM	NW63CF	114	63	2	17.4	CF-1	316LN	Tantalum	Yes
ISO63SVPZ-200-BBAR	ISO63	95	38	1.5	12	ISO-1	304L	Kovar	
VPZ100S-200-BBAR	NW100CF	152	89	2.5	19.9	CF-3	304L	Kovar	
VPZ100S-200-BBAR-LN	NW100CF	152	89	2.5	19.9	CF-3	316LN	Kovar	
VPZ100S-200-BBAR-NM	NW100CF	152	89	2.5	19.9	CF-3	316LN	Tantalum	Yes
ISO100SVPZ-200-BBAR	ISO100	130	63	2	12	ISO-2	304L	Kovar	
VPZ150S-200-BBAR	NW150CF	203	136	4	22.3	CF-3	304L	Kovar	
VPZ150S-200-BBAR-LN	NW150CF	203	136	4	22.3	CF-3	316LN	Kovar	
VPZ150S-BBAR-NM	NW150CF	203	136	4	22.3	CF-3	316LN	Tantalum	Yes
ISO160SVPZ-200-BBAR	ISO160	180	89	2.5	12	ISO-3	304L	Kovar	
VPZ200S-200-BBAR	NW200CF	254	136	4	24.5	CF-3	304L	Kovar	

Sapphire viewports with Broadband Anti-Reflective Coatings



# Sapphire viewports with 'VAR' Anti-Reflective Coatings

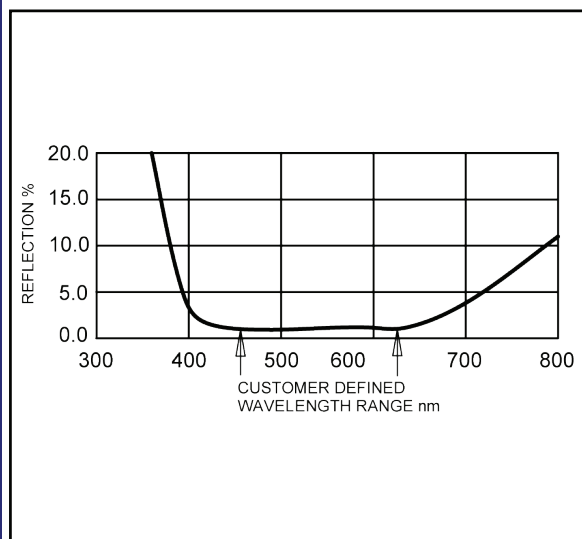
Sapphire viewports with 'VAR' Anti-Reflective Coatings



Specification	
Seal Type	Braze
Maximum Temperature	200°C (KF & ISO versions 150°C)
Minimum Temperature	minus 20°C
Maximum Rate of Temperature Change	3°C per minute
Leak Rate	<1x10 <sup>-10</sup> atm-cc/sec (He)
Pressure Range	1 bar to 1x10 <sup>-11</sup> mbar
Surface Quality	60 /40 scratch/dig
Flatness	< 8λ
Coating	2-layer 'VAR' coating optimised to customer specified wavelength between 240nm and 1550nm
Reflectance	< 0.5% per face 1% total at the specified wavelength

Torr Scientific Kodial viewports are offered with a four-layer broadband anti-reflective (BBAR) coating on both sides of the window optimised to a customer specified wavelength range. In many cases, the coating reduces reflection to below 0.5% per face or 1% total at the key wavelengths specified. Please advise the important wavelengths or wavelength range with your enquiry or order. Wavelength ranges between 240nm and 1550nm can be accepted as standard, although coatings for other wavelength ranges can be quoted on request. Viewports with 'V' coatings for a single wavelength for laser applications are also offered. Torr Scientific sapphire viewports are offered in CF, ISO and KF flange styles. The viewports comprise a high quality optic with precise flatness, parallelism, scratch and dig specifications. The single crystal sapphire windows have excellent optical, physical and chemical properties. The hardest of the oxide crystals, sapphire retains its high strength at high temperatures. Sapphire has a low coefficient of thermal expansion and low fluorescence, good resistance to thermal shock and scratching making this an excellent material for IR transmitting optics and robust applications. C-cut sapphire is selected for Torr Scientific sapphire viewports to minimise the effects of birefringence. The ultra high vacuum (UHV) CF versions are offered using high grade 304L or 316LN stainless steel flanges. Non-magnetic viewports are offered for low energy applications or surface science applications needing low magnetic fields. The non-magnetic viewports use a tantalum weld ring instead of the regular kovar weld ring. Flanges in 316L stainless steel are used for the high vacuum KF and ISO viewports. TSL viewports are manufactured in cleanroom conditions and helium leak tested, cleaned and packed to UHV standards. The rugged construction of the sapphire viewports allows repeated bake-out to 200°C with UHV performance, whilst the window offers broadband optical transmission through vacuum UV, visible to near infra-red. Non-standard viewports can be manufactured on request, including re-entrant style microscope/camera viewports. Annealed copper gaskets and other component accessories are also supplied by TSL.

## Reflectance Curve



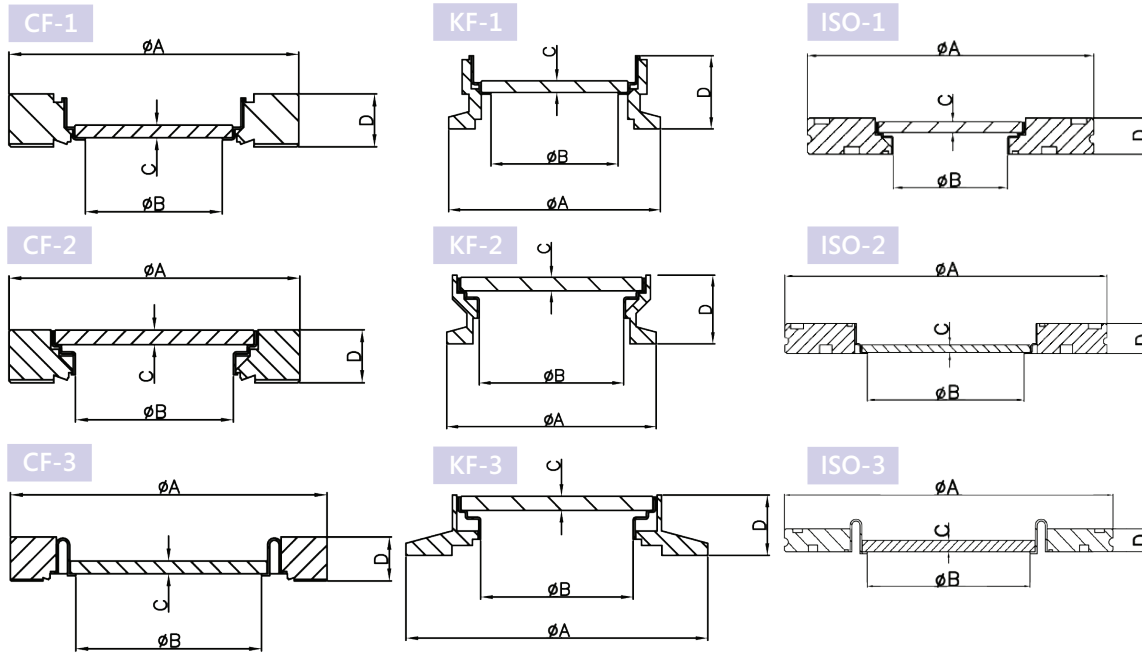
## The TSL UV-Vis Spectrophotometer



Please note that the optical reflectance curves are approximations and should be used for reference only



# Sapphire viewports with 'VAR' Anti-Reflective Coatings



Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring Material	Non-Magnetic
VPZ16S-200-VAR	NW16CF	34	15	1.5	12.7	CF-1	304L	Kovar	
VPZ16S-200-VAR-LN	NW16CF	34	15	1.5	12.7	CF-1	316LN	Kovar	
VPZ16S-200-VAR-NM	NW16CF	34	15	1.5	12.7	CF-1	316LN	Tantalum	Yes
KVPZ16S-200-VAR	KF16	25	15	1.5	12.7	KF-1	304L	Kovar	
KVPZ25S-200-VAR	KF25	40	20	1.5	18.5	KF-2	304L	Kovar	
VPZ23S-200-VAR	NW35CF	70	23	1.5	12.7	CF-1	304L	Kovar	
VPZ38S-200-VAR	NW35CF	70	32	1.5	12.7	CF-3	304L	Kovar	
VPZ38LAS-200-VAR	NW35CF	70	38	1.5	12.7	CF-2	304L	Kovar	
VPZ38S-200-VAR-LN	NW35CF	70	32	1.5	12.7	CF-1	316LN	Kovar	
VPZ38LAS-200-VAR-LN	NW35CF	70	38	1.5	12.7	CF-2	316LN	Kovar	
VPZ38S-200-VAR-NM	NW35CF	70	32	1.5	12.7	CF-1	316LN	Tantalum	Yes
KVPZ40/32S-200-VAR	KF40	55	32	1.5	12.7	KF-1	304L	Kovar	
KVPZ40S-200-VAR	KF40	55	38	1.5	18.5	KF-3	304L	Kovar	
KVPZ50S-200-VAR	KF50	75	38	1.5	15	KF-3	304L	Kovar	
VPZ64S-200-VAR	NW63CF	114	63	2	17.4	CF-1	304L	Kovar	
VPZ64S-200-VAR-LN	NW63CF	114	63	2	17.4	CF-1	316LN	Kovar	
VPZ64S-200-VAR-NM	NW63CF	114	63	2	17.4	CF-1	316LN	Tantalum	Yes
ISO63SVPZ-200-VAR	ISO63	95	38	1.5	12	ISO-1	304L	Kovar	
VPZ100S-200-VAR	NW100CF	152	89	2.5	19.9	CF-3	304L	Kovar	
VPZ100S-200-VAR-LN	NW100CF	152	89	2.5	19.9	CF-3	316LN	Kovar	
VPZ100S-200-VAR-NM	NW100CF	152	89	2.5	19.9	CF-3	316LN	Tantalum	Yes
ISO100SVPZ-200-VAR	ISO100	130	63	2	12	ISO-2	304L	Kovar	
VPZ150S-200-VAR	NW150CF	203	136	4	22.3	CF-3	304L	Kovar	
VPZ150S-200-VAR-LN	NW150CF	203	136	4	22.3	CF-3	316LN	Kovar	
VPZ150S-200-VAR-NM	NW150CF	203	136	4	22.3	CF-3	316LN	Tantalum	Yes
ISO160SVPZ-200-VAR	ISO160	180	89	2.5	12	ISO-3	304L	Kovar	
VPZ200S-200-VAR	NW200CF	254	136	4	24.5	CF-3	304L	Kovar	

Sapphire viewports with 'VAR' Anti-Reflective Coatings