Thin Films & AR Coated Viewports

Thin Film Coatings

Torr Scientific utilises in house e-beam and DC magnetron sputtering systems. The company predominantly processes anti-reflective coatings on vacuum viewports, but extensive expertise and technology is also applied in the field of coating to other applications such as EMC protection. Sputter coating is one of the most advanced processes by which thin films of virtually any metal can be deposited uniformly over complex shapes. Virtually any plastic, ceramic or glass substrate can be coated. Metallic films thus deposited are strongly adhering, durable, and very dense, so therefore have electrical properties closely approximating the bulk material. The ability to deposit virtually any metal or alloy such as Silver, Copper, Aluminium, Nickel and Stainless Steel etc. with the above characteristics makes the process ideal to the field of EMC shielding of enclosures made from plastics or other non-conducting materials. Torr Scientific also coats viewports with transparent conductive coatings such as ITO (Indium Tin Oxide) to provide surface conductivity. Please contact Torr Scientific with details of your requirements.

ITO

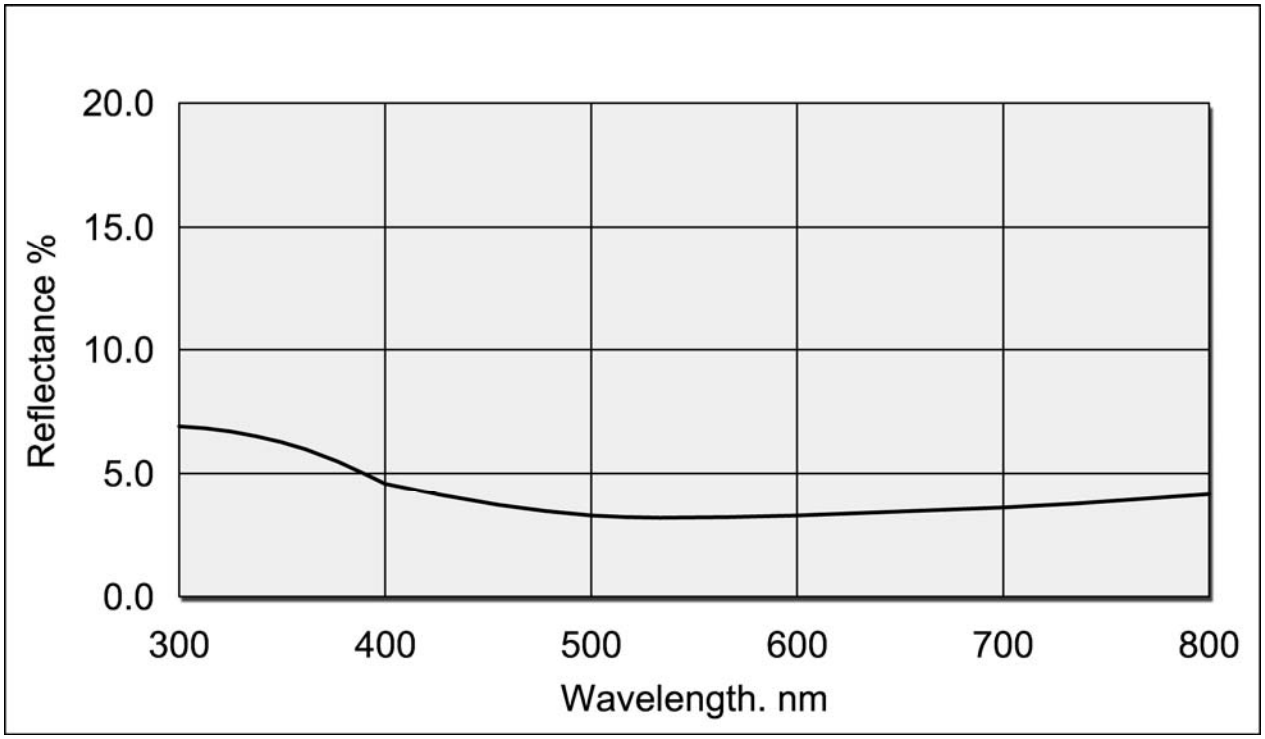
Indium Tin Oxide (ITO), a transparent semiconductor, is often used to coat glass to provide surface electrical conductivity, whilst still maintaining good transparency. This is necessary, for example, to prevent electrostatic charge build up. ITO is offered as standard on kodial and sapphire zero length viewports, but can be offered on non-standard substrates on request.

Anti-Reflective

All windows and viewports suffer reflectivity losses which can be in the order of 6% per face for high refractive windows such as sapphire. This problem can be a severe limitation in many applications requiring high transmission.

AR

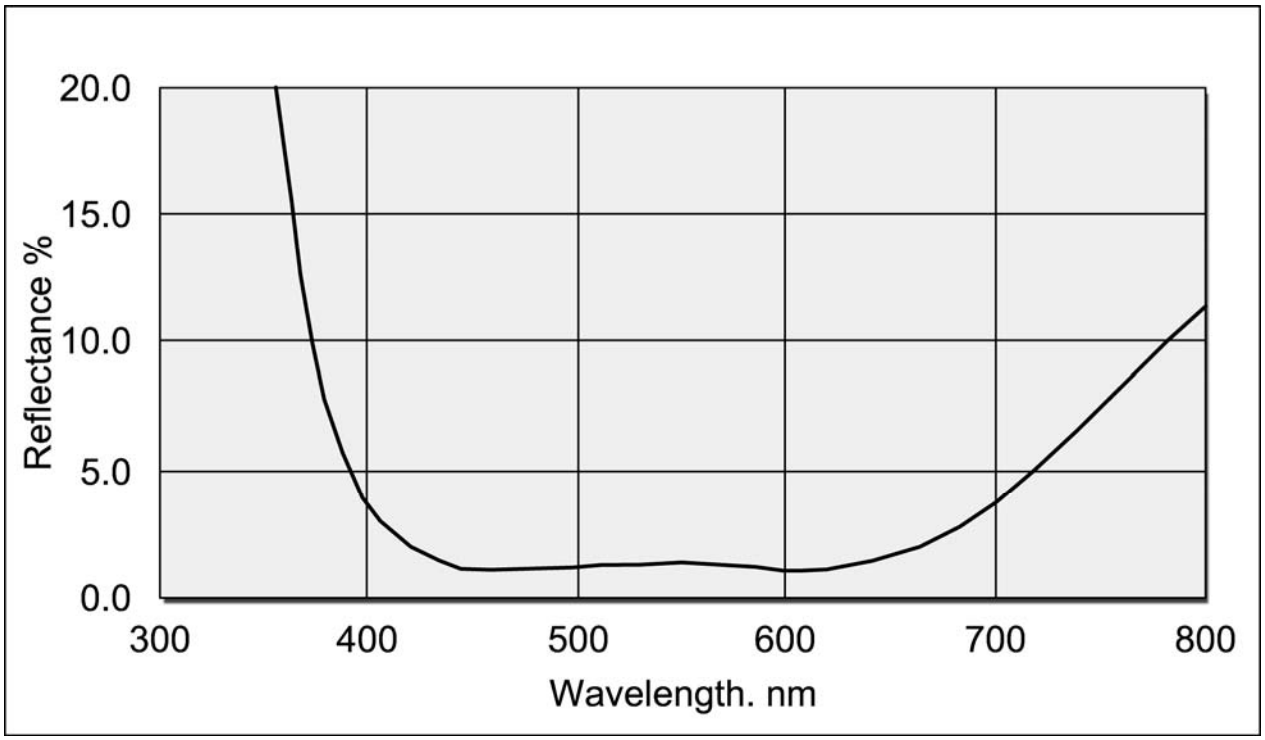
However, the problem can be mitigated using anti-reflective coatings. A considerable improvement can be obtained using a single QWOT (Quarter Wave Optical Thickness) of MgF2 as shown in the example below. The standard viewports with this coating have part codes ending 'AR'. The coating is applied both sides as standard. The regular 'AR' coating is centred around 550nm. Alternative coatings can be supplied. Please specify the wavelength of your application with enquiries or orders.



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

BBAR

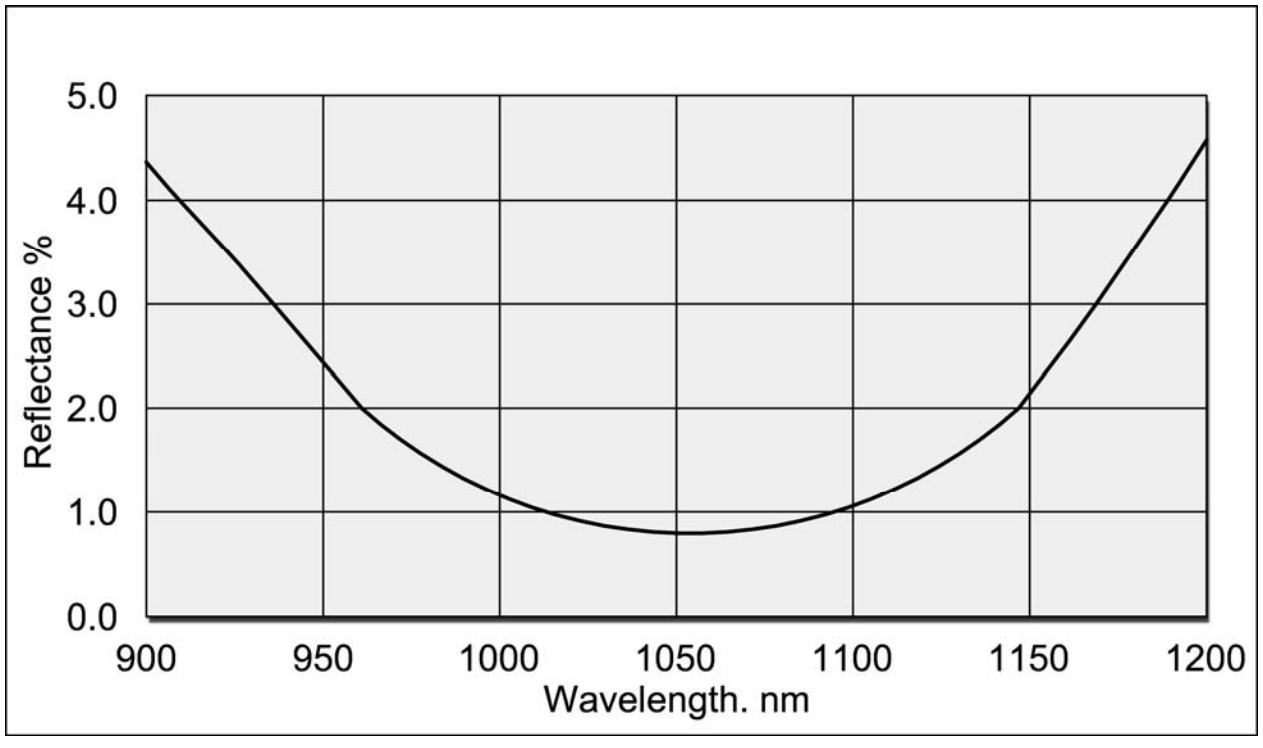
Multi-layer broadband anti-reflective (BBAR) coatings enable a wide variety of tailored reflection characteristics giving below 1% reflection over a wide wavelength range. The coating is applied on both sides of the viewport as standard. These are optimised typically for the visible range as per the example below. Please specify the wavelength range of your application with enquiries or orders.



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

VAR

Multi-layer anti-reflective (VAR) coatings can be processed for applications requiring the best transmission at a single wavelength, giving below 1% reflection at a specified wavelength. These are optimised typically for laser applications. The example below is optimised for 1064nm. Please specify the wavelength of your application with enquiries or orders.



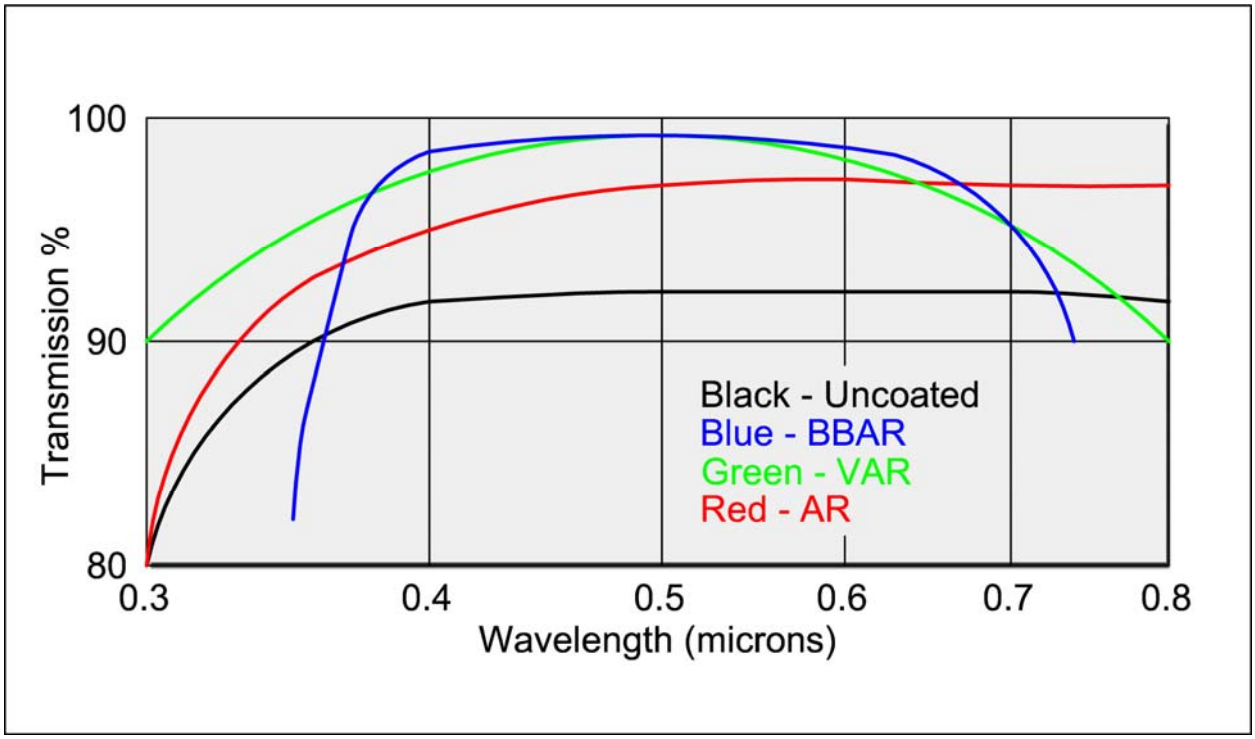
Please note that the optical reflectance curves are approximations and should be used for reference only

Kodial Zero Length Viewports with Anti-Reflective Coatings

Torr Scientific kodial viewports are offered in CF, ISO and KF flange styles. The clean, UHV CF versions are offered using 304L or 316LN stainless steel flanges. Flanges in 316L stainless steel are used for the high vacuum KF and ISO viewports. The rugged construction of the Kodial viewports allows repeated bake-out with ultra high vacuum (UHV) performance, whilst the window offers broadband optical transmission from the visible to near infra-red. A non-magnetic range of kodial viewports is offered with mechanical seals. Various anti-reflective coatings to match customer reflectance requirements are processed at TSL and available as options listed in the this section of the TSL catalogue. 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.

Transmission Curve– Kodial

The graph below shows typical before and after transmission effect of 'AR', 'VAR', and BBAR' anti-reflective coatings on Kodial Viewports. Customers should specify wavelength range of application with their enquiry.

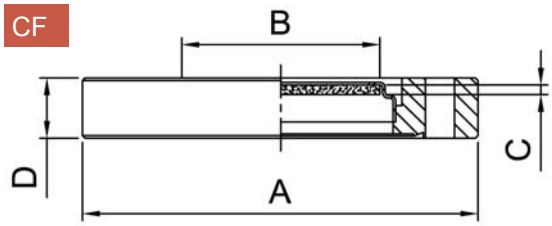


Please note that the optical transmission curves are approximations and should be used for reference only

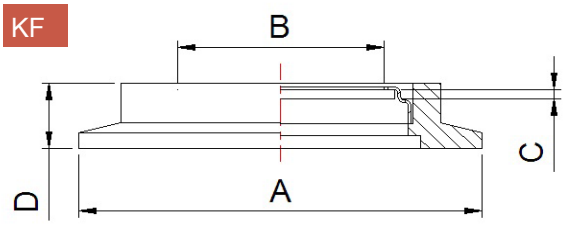
Kodial Zero Length Viewports with Anti-Reflective Coatings

Specification	
Seal Type	Braze
Temperature	Max 350°C (KF versions 150°C)
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	20 /10 scratch/dig
Flatness	< 8λ

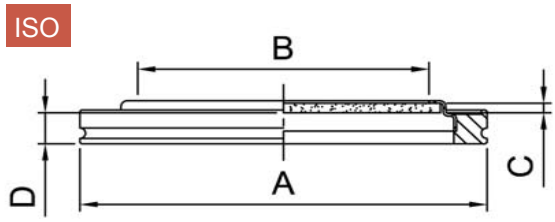
CF



KF



ISO



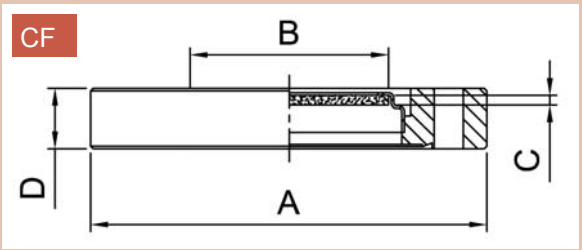
Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Coating. Please refer to pages 2 to 4. Please specify wavelength or wavelength range of application
VPZ16AR	NW16CF	34	15	1	12.7	CF	304L	Kovar	AR
VPZ16AR-LN	NW16CF	34	15	1	12.7	CF	316LN	Kovar	AR
KVPZ25AR	KF25	40	20	1.5	18.5	KF	316L	Kovar	AR
VPZ38AR	NW35CF	70	32	2.5	12.7	CF	304L	Kovar	AR
VPZ38LAAR	NW35CF	70	38	3	12.7	CF	304L	Kovar	AR
VPZ38AR-LN	NW35CF	70	32	2.5	12.7	CF	316LN	Kovar	AR
VPZ38LAAR-LN	NW35CF	70	38	3	12.7	CF	316LN	Kovar	AR
KVPZ40AR	KF40	55	38	3	18.5	KF	316L	Kovar	AR
KVPZ50AR	KF50	75	38	3	15	KF	316L	Kovar	AR
ISO63VPZAR	ISO63	95	38	3	12	ISO	316L	Kovar	AR
VPZ64AR	NW63CF	114	63	3	17.4	CF	304L	Kovar	AR
VPZ64AR-LN	NW63CF	114	63	3	17.4	CF	316LN	Kovar	AR
VPZ100AR	NW100CF	152	89	4	19.9	CF	304L	Kovar	AR
VPZ100AR-LN	NW100CF	152	89	4	19.9	CF	316LN	Kovar	AR
ISO100VPZAR	ISO100	130	63	3	12	ISO	316L	Kovar	AR
VPZ150AR	NW150CF	203	136	6.5	22.3	CF	304L	Kovar	AR
VPZ150AR-LN	NW150CF	203	136	6.5	22.3	CF	316LN	Kovar	AR
ISO160VPZAR	ISO160	180	89	4	12	ISO	316L	Kovar	AR
VPZ16BBAR	NW16CF	34	15	1	12.7	CF	304L	Kovar	BBAR
VPZ16BBAR-LN	NW16CF	34	15	1	12.7	CF	316LN	Kovar	BBAR
KVPZ25BBAR	KF25	40	20	1.5	18.5	KF	316L	Kovar	BBAR

Please see NEXT page for continued table of parts and further information

Continued from Previous page

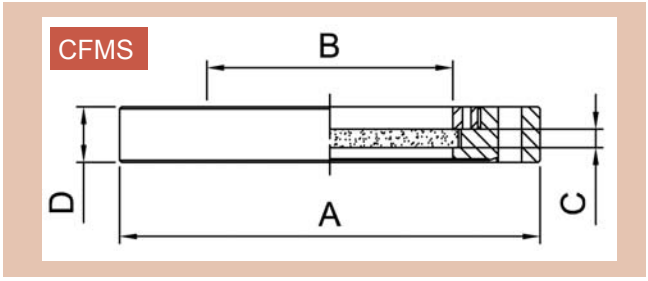
Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Coating. Please refer to pages 2 to 4. Please specify wavelength or
VPZ38BBAR	NW35CF	70	32	2.5	12.7	CF	304L	Kovar	BBAR
VPZ38LABBAR	NW35CF	70	38	3	12.7	CF	304L	Kovar	BBAR
VPZ38BBAR-LN	NW35CF	70	32	2.5	12.7	CF	316LN	Kovar	BBAR
VPZ38LABBAR-LN	NW35CF	70	38	3	12.7	CF	316LN	Kovar	BBAR
KVPZ40BBAR	KF40	55	38	3	18.5	KF	316L	Kovar	BBAR
KVPZ50BBAR	KF50	75	38	3	15	KF	316L	Kovar	BBAR
ISO63VPZBBAR	ISO63	95	38	3	12	ISO	316L	Kovar	BBAR
VPZ64BBAR	NW63CF	114	63	3	17.4	CF	304L	Kovar	BBAR
VPZ64BBAR-LN	NW63CF	114	63	3	17.4	CF	316LN	Kovar	BBAR
VPZ100BBAR	NW100CF	152	89	4	19.9	CF	304L	Kovar	BBAR
VPZ100BBAR-LN	NW100CF	152	89	4	19.9	CF	316LN	Kovar	BBAR
ISO100VPZBBAR	ISO100	130	63	3	12	ISO	316L	Kovar	BBAR
VPZ150BBAR	NW150CF	203	136	6.5	22.3	CF	304L	Kovar	BBAR
VPZ150BBAR-LN	NW150CF	203	136	6.5	22.3	CF	316LN	Kovar	BBAR
ISO160VPZBBAR	ISO160	180	89	4	12	ISO	316L	Kovar	BBAR
VPZ16VAR	NW16CF	34	15	1	12.7	CF	304L	Kovar	VAR
VPZ16VAR-LN	NW16CF	34	15	1	12.7	CF	316LN	Kovar	VAR
KVPZ25VAR	KF25	40	20	1.5	18.5	KF	316L	Kovar	VAR
VPZ38VAR	NW35CF	70	32	2.5	12.7	CF	304L	Kovar	VAR
VPZ38LAVAR	NW35CF	70	38	3	12.7	CF	304L	Kovar	VAR
VPZ38VAR-LN	NW35CF	70	32	2.5	12.7	CF	316LN	Kovar	VAR
VPZ38LAVAR-LN	NW35CF	70	38	3	12.7	CF	316LN	Kovar	VAR
KVPZ40VAR	KF40	55	38	3	18.5	KF	316L	Kovar	VAR
KVPZ50VAR	KF50	75	38	3	15	KF	316L	Kovar	VAR
ISO63VPZVAR	ISO63	95	38	3	12	ISO	316L	Kovar	VAR
VPZ64VAR	NW63CF	114	63	3	17.4	CF	304L	Kovar	VAR
VPZ64VAR-LN	NW63CF	114	63	3	17.4	CF	316LN	Kovar	VAR
VPZ100VAR	NW100CF	152	89	4	19.9	CF	304L	Kovar	VAR
VPZ100VAR-LN	NW100CF	152	89	4	19.9	CF	316LN	Kovar	VAR
ISO100VPZVAR	ISO100	130	63	3	12	ISO	316L	Kovar	VAR
VPZ150VAR	NW150CF	203	136	6.5	22.3	CF	304L	Kovar	VAR
VPZ150VAR-LN	NW150CF	203	136	6.5	22.3	CF	316LN	Kovar	VAR
ISO160VPZVAR	ISO160	180	89	4	12	ISO	316L	Kovar	VAR

Specification	
Seal Type	Bond
Temperature	Max 120°C
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	20 /10 scratch/dig
Flatness	λ/4



Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Coating. Please refer to pages 2 to 4. Please specify wavelength or wavelength range of application
BVPZ16AR-NM	NW16CF	34	15	1	12.7	CF	316LN	Tantalum	AR
BVPZ38AR-NM	NW35CF	70	32	2.5	12.7	CF	316LN	Tantalum	AR
BVPZ64AR-NM	NW63CF	114	63	3	17.4	CF	316LN	Tantalum	AR
BVPZ150AR-NM	NW150CF	203	136	6.5	22.3	CF	316LN	Tantalum	AR
BVPZ16BBAR-NM	NW16CF	34	15	1	12.7	CF	316LN	Tantalum	BBAR
BVPZ38BBAR-NM	NW35CF	70	32	2.5	12.7	CF	316LN	Tantalum	BBAR
BVPZ64BBAR-NM	NW63CF	114	63	3	17.4	CF	316LN	Tantalum	BBAR
BVPZ150BBAR-NM	NW150CF	203	136	6.5	22.3	CF	316LN	Tantalum	BBAR
BVPZ16VAR-NM	NW16CF	34	15	1	12.7	CF	316LN	Tantalum	VAR
BVPZ38VAR-NM	NW35CF	70	32	2.5	12.7	CF	316LN	Tantalum	VAR
BVPZ64VAR-NM	NW63CF	114	63	3	17.4	CF	316LN	Tantalum	VAR
BVPZ150VAR-NM	NW150CF	203	136	6.5	22.3	CF	316LN	Tantalum	VAR

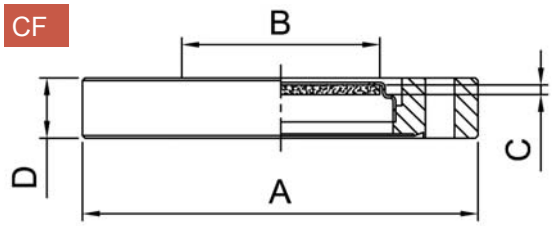
Specification	
Seal Type	Mechanically Sealed
Temperature	Max 130°C
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	20 /10 scratch/dig
Flatness	λ/4



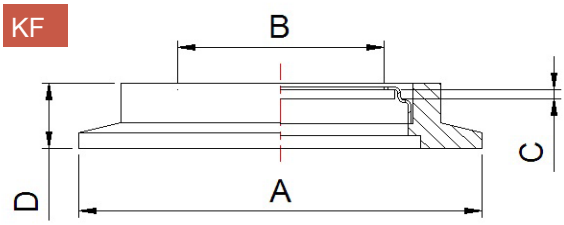
Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Non-Magnetic	Coating. Please refer to pages 2 to 4. Please specify wavelength or wavelength range of application
VPZ38AR-MS	NW35CF	70	32	2.5	12.7	CFMS	304L	n/a		AR
VPZ38AR-NM-MS	NW35CF	70	32	2.5	12.7	CFMS	316LN	n/a	Yes	AR
VPZ64AR-MS	NW63CF	114	63	3	17.4	CFMS	304L	n/a		AR
VPZ64AR-NM-MS	NW63CF	114	63	3	17.4	CFMS	316LN	n/a	Yes	AR
VPZ100AR-MS	NW100CF	152	89	4	19.9	CFMS	304L	n/a		AR
VPZ100AR-NM-MS	NW100CF	152	89	4	19.9	CFMS	316LN	n/a	Yes	AR
VPZ38BBAR-MS	NW35CF	70	32	2.5	12.7	CFMS	304L	n/a		BBAR
VPZ38BBAR-NM-MS	NW35CF	70	32	2.5	12.7	CFMS	316LN	n/a	Yes	BBAR
VPZ64BBAR-MS	NW63CF	114	63	3	17.4	CFMS	304L	n/a		BBAR
VPZ64BBAR-NM-MS	NW63CF	114	63	3	17.4	CFMS	316LN	n/a	Yes	BBAR
VPZ100BBAR-MS	NW100CF	152	89	4	19.9	CFMS	304L	n/a		BBAR
VPZ100BBAR-NM-MS	NW100CF	152	89	4	19.9	CFMS	316LN	n/a	Yes	BBAR
VPZ38VAR-MS	NW35CF	70	32	2.5	12.7	CFMS	304L	n/a		VAR
VPZ38VAR-NM-MS	NW35CF	70	32	2.5	12.7	CFMS	316LN	n/a	Yes	VAR
VPZ64VAR-MS	NW63CF	114	63	3	17.4	CFMS	304L	n/a		VAR
VPZ64VAR-NM-MS	NW63CF	114	63	3	17.4	CFMS	316LN	n/a	Yes	VAR
VPZ100VAR-MS	NW100CF	152	89	4	19.9	CFMS	304L	n/a		VAR
VPZ100VAR-NM-MS	NW100CF	152	89	4	19.9	CFMS	316LN	n/a	Yes	VAR

Specification	
Seal Type	Braze
Temperature	Max 350°C (KF versions 150°C)
Leak Rate	$<1x10^{-10}$ atm-cc/sec (He)
Pressure range	$<1x10^{-11}$ Torr
Surface quality	20 /10 scratch/dig
Flatness	< 8λ

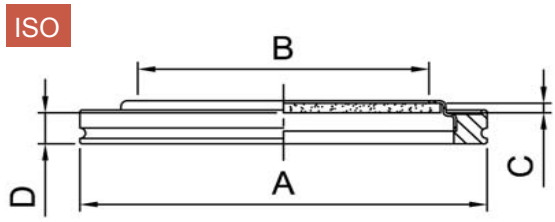
CF



KF



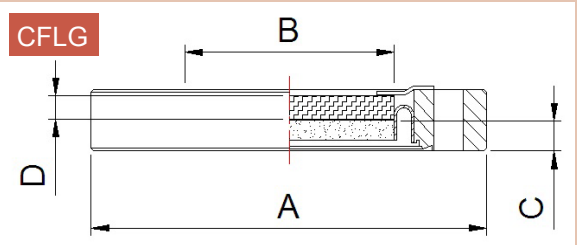
ISO



Indium Tin Oxide (ITO), a transparent semiconductor, is often used to coat glass to provide surface electrical conductivity, whilst still maintaining good transparency. This is necessary, for example, to prevent electrostatic charge build up. ITO is offered as standard on kodial and sapphire zero length viewports, but can be offered on non-standard substrates on request. The ITO coating is applied to the vacuum side of the window as standard.

Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Coating
VPZ16ITO	NW16CF	34	15	1	12.7	CF	304L	Kovar	ITO
VPZ16ITO-LN	NW16CF	34	15	1	12.7	CF	316LN	Kovar	ITO
KVPZ25ITO	KF25	40	20	1.5	18.5	KF	316L	Kovar	ITO
VPZ38ITO	NW35CF	70	32	2.5	12.7	CF	304L	Kovar	ITO
VPZ38ITO-LN	NW35CF	70	32	2.5	12.7	CF	316LN	Kovar	ITO
KVPZ40ITO	KF40	55	38	3	18.5	KF	316L	Kovar	ITO
KVPZ50ITO	KF50	75	38	3	15	KF	316L	Kovar	ITO
ISO63VPZITO	ISO63	95	38	3	12	ISO	316L	Kovar	ITO
VPZ64ITO	NW63CF	114	63	3	17.4	CF	304L	Kovar	ITO
VPZ64ITO-LN	NW63CF	114	63	3	17.4	CF	316LN	Kovar	ITO
VPZ100ITO	NW100CF	152	89	4	19.9	CF	304L	Kovar	ITO
VPZ100ITO-LN	NW100CF	152	89	4	19.9	CF	316LN	Kovar	ITO
ISO100VPZITO	ISO100	130	63	3	12	ISO	316L	Kovar	ITO
VPZ150ITO	NW150CF	203	136	6.5	22.3	CF	304L	Kovar	ITO
VPZ150ITO-LN	NW150CF	203	136	6.5	22.3	CF	316LN	Kovar	ITO
ISO160VPZITO	ISO160	180	89	4	12	ISO	316L	Kovar	ITO

Specification	
Seal Type	Braze
Temperature	Max 350°C
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	20 /10 scratch/dig
Flatness	< 8λ



In addition to ITO coating, these Viewports are offered with Lead Glass discs attached. For details of the Lead Glass please see page 4 of the Viewports section.

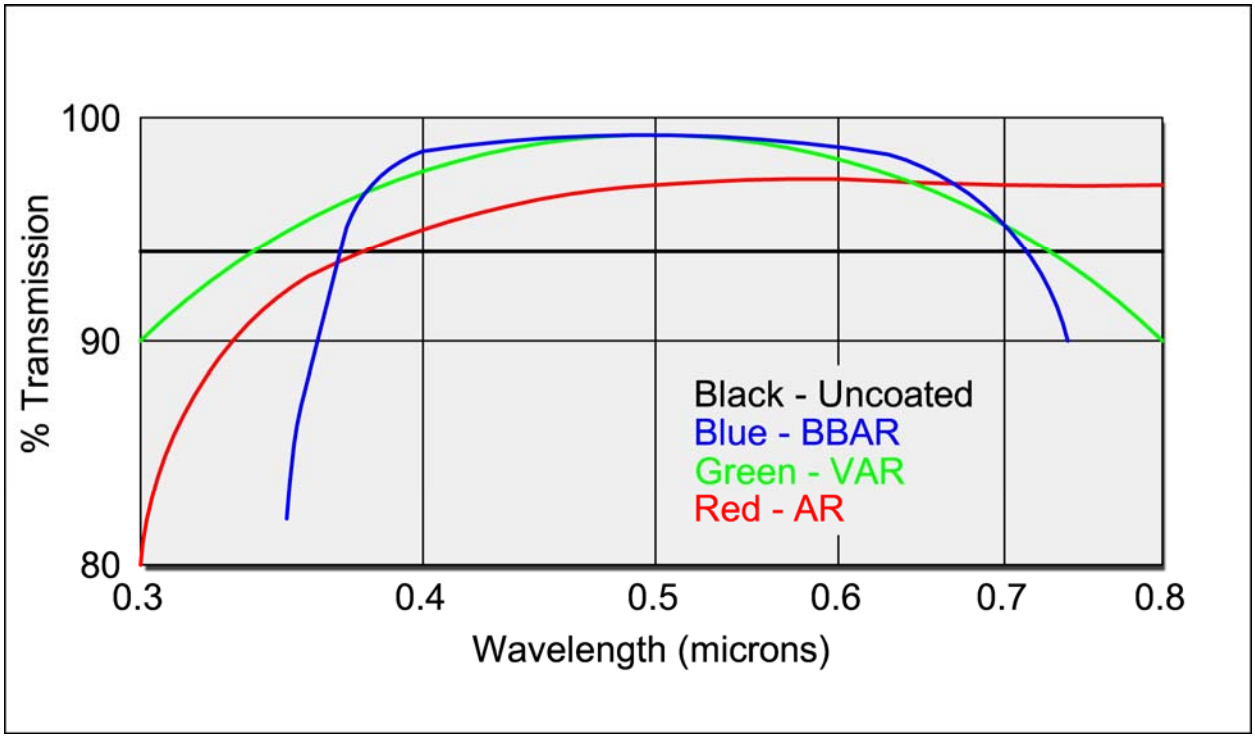
Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Coating
VPZ16ITOLG	NW16CF	34	15	1	6	CFLG	304L	Kovar	ITO
VPZ16ITOLG-LN	NW16CF	34	15	1	6	CFLG	316LN	Kovar	ITO
VPZ38ITOLG	NW35CF	70	32	2.5	6	CFLG	304L	Kovar	ITO
VPZ38ITOLG-LN	NW35CF	70	32	2.5	6	CFLG	316LN	Kovar	ITO
VPZ64ITOLG	NW63CF	114	63	3	6	CFLG	304L	Kovar	ITO
VPZ64ITOLG-LN	NW63CF	114	63	3	6	CFLG	316LN	Kovar	ITO
VPZ100ITOLG	NW100CF	152	89	4	6	CFLG	304L	Kovar	ITO
VPZ100ITOLG-LN	NW100CF	152	89	4	6	CFLG	316LN	Kovar	ITO
VPZ150ITOLG	NW150CF	203	136	6.5	6	CFLG	304L	Kovar	ITO
VPZ150ITOLG-LN	NW150CF	203	136	6.5	6	CFLG	316LN	Kovar	ITO

Fused Silica Zero Length Viewports with Anti-Reflective Coatings

Torr Scientific fused silica viewports are offered in CF, ISO and KF flange styles. The clean, UHV CF versions are offered using 304L or 316LN stainless steel flanges. Non-magnetic viewports are offered as standard using 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. The rugged construction of the fused silica viewports allows repeated bake-out with ultra high vacuum (UHV) performance, whilst the window offers broadband optical transmission through deep UV, visible to near infra-red. Various anti-reflective coatings to match customer reflectance requirements are processed at TSL and available as options listed in this section of the TSL catalogue. 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.

Transmission Curve– Fused Silica

The graph below shows typical before and after transmission effect of 'AR', 'VAR', and BBAR' anti-reflective coatings on Fused Silica Viewports. Customers should specify wavelength range of application with their enquiry.

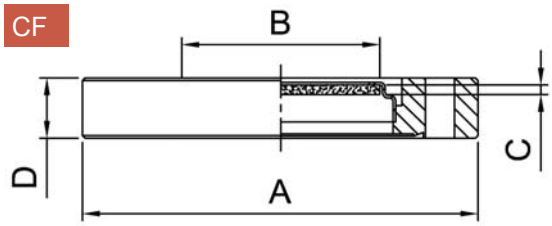


Please note that the optical transmission curves are approximations and should be used for reference only

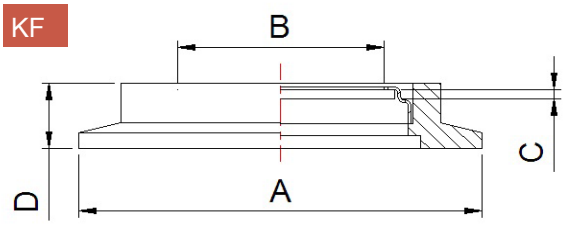
Fused Silica Zero Length Viewports with Anti-Reflective Coatings

Specification	
Seal Type	Braze
Temperature	Max 200°C (KF versions 150°C)
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	20 /10 scratch/dig
Flatness	< 8λ

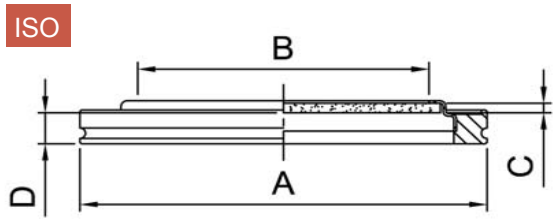
CF



KF



ISO



Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Non-Magnetic	Coating. Please refer to pages 2, 3 and 12. Please specify wavelength or wavelength range of
VPZ16QAR	NW16CF	34	15	1.5	12.7	CF	304L	Kovar		AR
VPZ16QAR-LN	NW16CF	34	15	1.5	12.7	CF	316LN	Kovar		AR
VPZ16QAR-NM	NW16CF	34	15	1.5	12.7	CF	316LN	Tantalum	Yes	AR
KVPZ25QAR	KF25	40	20	2	18.5	KF	316L	Kovar		AR
VPZ38QAR	NW35CF	70	32	3	12.7	CF	304L	Kovar		AR
VPZ38LAQAR	NW35CF	70	38	3.5	12.7	CF	304L	Kovar		AR
VPZ38QAR-LN	NW35CF	70	32	3	12.7	CF	316LN	Kovar		AR
VPZ38LAQAR-LN	NW35CF	70	38	3.5	12.7	CF	316LN	Kovar		AR
VPZ38QAR-NM	NW35CF	70	32	3	12.7	CF	316LN	Tantalum	Yes	AR
KVPZ40QAR	KF40	55	38	3.5	18.5	KF	316L	Kovar		AR
KVPZ50QAR	KF50	75	38	3.5	15	KF	316L	Kovar		AR
ISO63QVPZAR	ISO63	95	38	3.5	12	ISO	316L	Kovar		AR
VPZ64QAR	NW63CF	114	63	4.5	17.4	CF	304L	Kovar		AR
VPZ64QAR-LN	NW63CF	114	63	4.5	17.4	CF	316LN	Kovar		AR
VPZ64QAR-NM	NW63CF	114	63	4.5	17.4	CF	316LN	Tantalum	Yes	AR
VPZ100QAR	NW100CF	152	89	6	19.9	CF	304L	Kovar		AR
VPZ100QAR-LN	NW100CF	152	89	6	19.9	CF	316LN	Kovar		AR
VPZ100QAR-NM	NW100CF	152	89	6	19.9	CF	316LN	Tantalum	Yes	AR
ISO100QVPZAR	ISO100	130	63	4.5	12	ISO	316L	Kovar		AR
VPZ150QAR	NW150CF	203	136	9.5	22.3	CF	304L	Kovar		AR
VPZ150QAR-LN	NW150CF	203	136	9.5	22.3	CF	316LN	Kovar		AR
VPZ150QAR-NM	NW150CF	203	136	9.5	22.3	CF	316LN	Tantalum	Yes	AR
ISO160QVPZAR	ISO160	180	89	6	12	ISO	316L	Kovar		AR

Please see NEXT page for continued table of parts and further information

Continued from Previous page

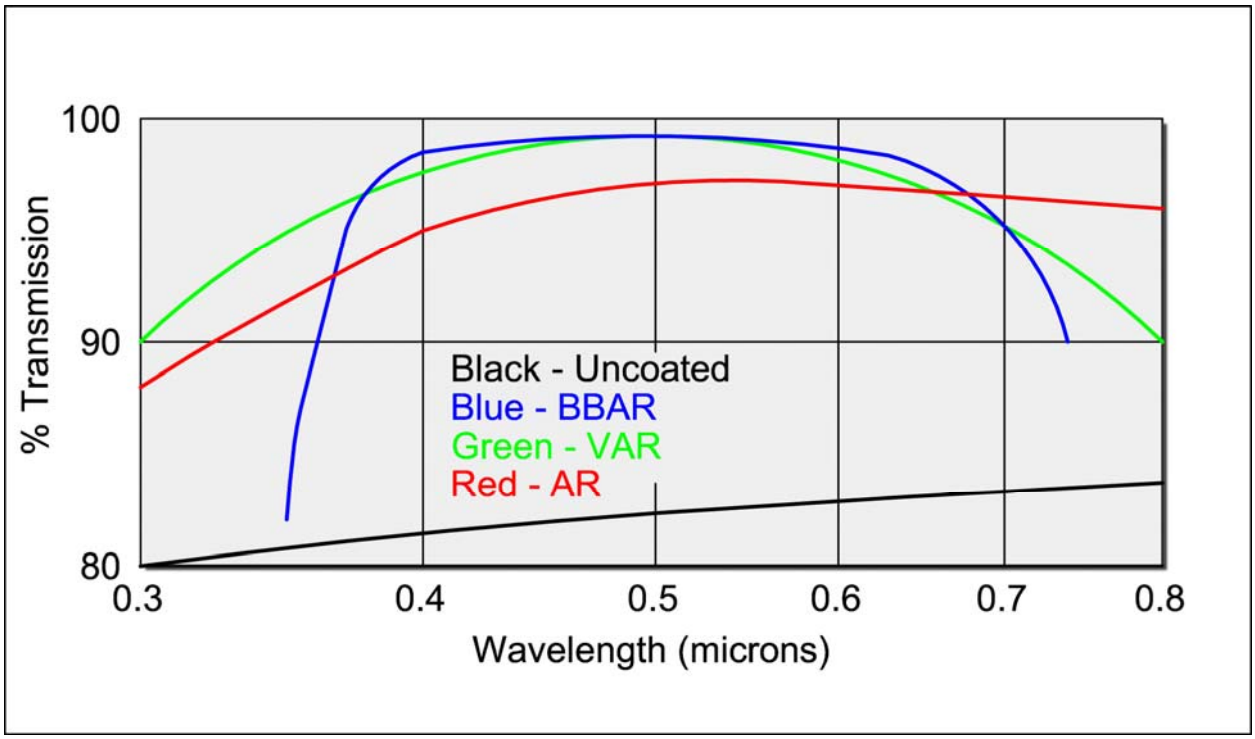
Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Non-Magnetic	Coating. Please refer to pages 2, 3 and 12. Please specify wavelength or wavelength range of application
VPZ16QBBAR	NW16CF	34	15	1.5	12.7	CF	304L	Kovar		BBAR
VPZ16QBBAR-LN	NW16CF	34	15	1.5	12.7	CF	316LN	Kovar		BBAR
VPZ16QBBAR-NM	NW16CF	34	15	1.5	12.7	CF	316LN	Tantalum	Yes	BBAR
KVPZ25QBBAR	KF25	40	20	2	18.5	KF	316L	Kovar		BBAR
VPZ38QBBAR	NW35CF	70	32	3	12.7	CF	304L	Kovar		BBAR
VPZ38LAQBBAR	NW35CF	70	38	3.5	12.7	CF	304L	Kovar		BBAR
VPZ38QBBAR-LN	NW35CF	70	32	3	12.7	CF	316LN	Kovar		BBAR
VPZ38LAQBBAR-LN	NW35CF	70	38	3.5	12.7	CF	316LN	Kovar		BBAR
VPZ38QBBAR-NM	NW35CF	70	32	3	12.7	CF	316LN	Tantalum	Yes	BBAR
KVPZ40QBBAR	KF40	55	38	3.5	18.5	KF	316L	Kovar		BBAR
KVPZ50QBBAR	KF50	75	38	3.5	15	KF	316L	Kovar		BBAR
ISO63QVPZBBAR	ISO63	95	38	3.5	12	ISO	316L	Kovar		BBAR
VPZ64QBBAR	NW63CF	114	63	4.5	17.4	CF	304L	Kovar		BBAR
VPZ64QBBAR-LN	NW63CF	114	63	4.5	17.4	CF	316LN	Kovar		BBAR
VPZ64QBBAR-NM	NW63CF	114	63	4.5	17.4	CF	316LN	Tantalum	Yes	BBAR
VPZ100QBBAR	NW100CF	152	89	6	19.9	CF	304L	Kovar		BBAR
VPZ100QBBAR-LN	NW100CF	152	89	6	19.9	CF	316LN	Kovar		BBAR
VPZ100QBBAR-NM	NW100CF	152	89	6	19.9	CF	316LN	Tantalum	Yes	BBAR
ISO100QVPZBBAR	ISO100	130	63	4.5	12	ISO	316L	Kovar		BBAR
VPZ150QBBAR	NW150CF	203	136	9.5	22.3	CF	304L	Kovar		BBAR
VPZ150QBBAR-LN	NW150CF	203	136	9.5	22.3	CF	316LN	Kovar		BBAR
VPZ150QBBAR-NM	NW150CF	203	136	9.5	22.3	CF	316LN	Tantalum	Yes	BBAR
ISO160QVPZBBAR	ISO160	180	89	6	12	ISO	316L	Kovar		BBAR
VPZ16QVAR	NW16CF	34	15	1.5	12.7	CF	304L	Kovar		VAR
VPZ16QVAR-LN	NW16CF	34	15	1.5	12.7	CF	316LN	Kovar		VAR
VPZ16QVAR-NM	NW16CF	34	15	1.5	12.7	CF	316LN	Tantalum	Yes	VAR
KVPZ25QVAR	KF25	40	20	2	18.5	KF	316L	Kovar		VAR
VPZ38QVAR	NW35CF	70	32	3	12.7	CF	304L	Kovar		VAR
VPZ38QLAVAR	NW35CF	70	38	3.5	12.7	CF	304L	Kovar		VAR
VPZ38QVAR-LN	NW35CF	70	32	3	12.7	CF	316LN	Kovar		VAR
VPZ38LAQVAR-LN	NW35CF	70	38	3.5	12.7	CF	316LN	Kovar		VAR
VPZ38QVAR-NM	NW35CF	70	32	3	12.7	CF	316LN	Tantalum	Yes	VAR
KVPZ40QVAR	KF40	55	38	3.5	18.5	KF	316L	Kovar		VAR
KVPZ50QVAR	KF50	75	38	3.5	15	KF	316L	Kovar		VAR
ISO63QVPZVAR	ISO63	95	38	3.5	12	ISO	316L	Kovar		VAR
VPZ64QVAR	NW63CF	114	63	4.5	17.4	CF	304L	Kovar		VAR
VPZ64QVAR-LN	NW63CF	114	63	4.5	17.4	CF	316LN	Kovar		VAR
VPZ64QVAR-NM	NW63CF	114	63	4.5	17.4	CF	316LN	Tantalum	Yes	VAR
VPZ100QVAR	NW100CF	152	89	6	19.9	CF	304L	Kovar		VAR
VPZ100QVAR-LN	NW100CF	152	89	6	19.9	CF	316LN	Kovar		VAR
VPZ100QVAR-NM	NW100CF	152	89	6	19.9	CF	316LN	Tantalum	Yes	VAR
ISO100QVPZVAR	ISO100	130	63	4.5	12	ISO	316L	Kovar		VAR
VPZ150QVAR	NW150CF	203	136	9.5	22.3	CF	304L	Kovar		VAR
VPZ150QVAR-LN	NW150CF	203	136	9.5	22.3	CF	316LN	Kovar		VAR
VPZ150QVAR-NM	NW150CF	203	136	9.5	22.3	CF	316LN	Tantalum	Yes	VAR
ISO160QVPZVAR	ISO160	180	89	6	12	ISO	316L	Kovar		VAR

Sapphire Zero Length Viewports with Anti-Reflective Coatings

Torr Scientific sapphire viewports are offered in CF, ISO and KF flange styles. The clean, UHV CF versions are offered using 304L or 316LN stainless steel flanges. Non-magnetic viewports are offered as standard using 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. The rugged construction of the sapphire viewports allows repeated bake-out with ultra high vacuum (UHV) performance, whilst the window offers broadband optical transmission through vacuum UV, visible to near infra-red. 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. Various anti-reflective coatings to match customer reflectance requirements are processed at TSL and available as options listed in this section of the TSL catalogue. 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.

Transmission Curve– Sapphire

The graph below shows typical before and after transmission effect of 'AR', 'VAR', and BBAR' anti-reflective coatings on Sapphire Viewports. Customers should specify wavelength range of application with their enquiry.

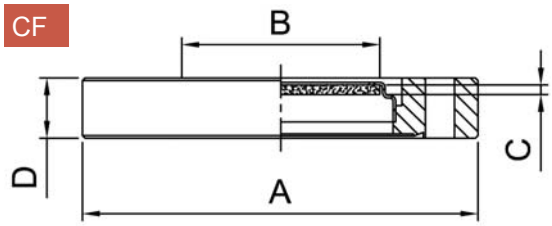


Please note that the optical transmission curves are approximations and should be used for reference only

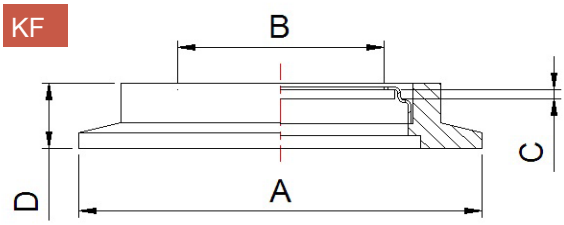
Sapphire Zero Length Viewports with Anti-Reflective Coatings

Specification	
Seal Type	Braze
Temperature	Max 450°C (KF versions 150°C)
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	60 /40 scratch/dig
Flatness	< 8λ

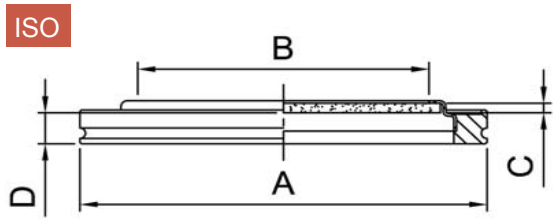
CF



KF



ISO



Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Non-Magnetic	Coating. Please refer to pages 2, 3 and 16. Please specify wavelength or wavelength range of application
VPZ16SAR	NW16CF	34	15	1.5	12.7	CF	304L	Kovar		AR
VPZ16SAR-LN	NW16CF	34	15	1.5	12.7	CF	316LN	Kovar		AR
VPZ16SAR-NM	NW16CF	34	15	1.5	12.7	CF	316LN	Tantalum	Yes	AR
KVPZ25SAR	KF25	40	20	1.5	18.5	KF	316L	Kovar		AR
VPZ38SAR	NW35CF	70	32	1.5	12.7	CF	304L	Kovar		AR
VPZ38LASAR	NW35CF	70	38	1.5	12.7	CF	304L	Kovar		AR
VPZ38SAR-LN	NW35CF	70	32	1.5	12.7	CF	316LN	Kovar		AR
VPZ38LASAR-LN	NW35CF	70	38	1.5	12.7	CF	316LN	Kovar		AR
VPZ38SAR-NM	NW35CF	70	32	1.5	12.7	CF	316LN	Tantalum	Yes	AR
KVPZ40SAR	KF40	55	38	1.5	18.5	KF	316L	Kovar		AR
KVPZ50SAR	KF50	75	38	1.5	15	KF	316L	Kovar		AR
VPZ64SAR	NW63CF	114	63	2	17.4	CF	304L	Kovar		AR
VPZ64SAR-LN	NW63CF	114	63	2	17.4	CF	316LN	Kovar		AR
VPZ64SAR-NM	NW63CF	114	63	2	17.4	CF	316LN	Tantalum	Yes	AR
ISO63SVPZAR	ISO63	95	38	1.5	12	ISO	316L	Kovar		AR
VPZ100SAR	NW100CF	152	89	2.5	19.9	CF	304L	Kovar		AR
VPZ100SAR-LN	NW100CF	152	89	2.5	19.9	CF	316LN	Kovar		AR
VPZ100SAR-NM	NW100CF	152	89	2.5	19.9	CF	316LN	Tantalum	Yes	AR
ISO100SVPZAR	ISO100	130	63	2	12	ISO	316L	Kovar		AR
VPZ150SAR	NW150CF	203	136	4	22.3	CF	304L	Kovar		AR
VPZ150SAR-LN	NW150CF	203	136	4	22.3	CF	316LN	Kovar		AR
VPZ150SAR-NM	NW150CF	203	136	4	22.3	CF	316LN	Tantalum	Yes	AR
ISO160SVPZAR	ISO160	180	89	2.5	12	ISO	316L	Kovar		AR
VPZ16SBBAR	NW16CF	34	15	1.5	12.7	CF	304L	Kovar		BBAR
VPZ16SBBAR-LN	NW16CF	34	15	1.5	12.7	CF	316LN	Kovar		BBAR

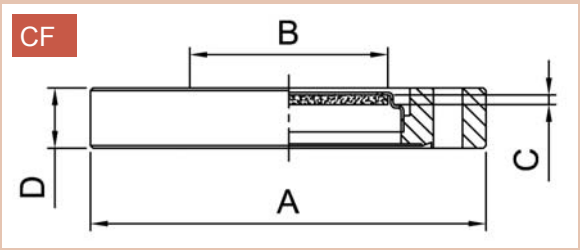
Please see NEXT page for continued table of parts and further information

Continued from Previous page

Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Non-Magnetic	Coating. Please refer to pages 2, 3 and 16. Please specify wavelength or wavelength range of application
VPZ16SBBAR-NM	NW16CF	34	15	1.5	12.7	CF	316LN	Tantalum	Yes	BBAR
KVPZ25SBBAR	KF25	40	20	1.5	18.5	KF	316L	Kovar		BBAR
VPZ38SBBAR	NW35CF	70	32	1.5	12.7	CF	304L	Kovar		BBAR
VPZ38LASBBAR	NW35CF	70	38	1.5	12.7	CF	304L	Kovar		BBAR
VPZ38SBBAR-LN	NW35CF	70	32	1.5	12.7	CF	316LN	Kovar		BBAR
VPZ38LASBBAR-LN	NW35CF	70	38	1.5	12.7	CF	316LN	Kovar		BBAR
VPZ38SBBAR-NM	NW35CF	70	32	1.5	12.7	CF	316LN	Tantalum	Yes	BBAR
KVPZ40SBBAR	KF40	55	38	1.5	18.5	KF	316L	Kovar		BBAR
KVPZ50SBBAR	KF50	75	38	1.5	15	KF	316L	Kovar		BBAR
VPZ64SBBAR	NW63CF	114	63	2	17.4	CF	304L	Kovar		BBAR
VPZ64SBBAR-LN	NW63CF	114	63	2	17.4	CF	316LN	Kovar		BBAR
VPZ64SBBAR-NM	NW63CF	114	63	2	17.4	CF	316LN	Tantalum	Yes	BBAR
ISO63SVPZBBAR	ISO63	95	38	1.5	12	ISO	316L	Kovar		BBAR
VPZ100SBBAR	NW100CF	152	89	2.5	19.9	CF	304L	Kovar		BBAR
VPZ100SBBAR-LN	NW100CF	152	89	2.5	19.9	CF	316LN	Kovar		BBAR
VPZ100SBBAR-NM	NW100CF	152	89	2.5	19.9	CF	316LN	Tantalum	Yes	BBAR
ISO100SVPZBBAR	ISO100	130	63	2	12	ISO	316L	Kovar		BBAR
VPZ150SBBAR	NW150CF	203	136	4	22.3	CF	304L	Kovar		BBAR
VPZ150SBBAR-LN	NW150CF	203	136	4	22.3	CF	316LN	Kovar		BBAR
VPZ150SBBAR-NM	NW150CF	203	136	4	22.3	CF	316LN	Tantalum	Yes	BBAR
ISO160SVPZBBAR	ISO160	180	89	2.5	12	ISO	316L	Kovar		BBAR
VPZ16SVAR	NW16CF	34	15	1.5	12.7	CF	304L	Kovar		VAR
VPZ16SVAR-LN	NW16CF	34	15	1.5	12.7	CF	316LN	Kovar		VAR
VPZ16SVAR-NM	NW16CF	34	15	1.5	12.7	CF	316LN	Tantalum	Yes	VAR
KVPZ25SVAR	KF25	40	20	1.5	18.5	KF	316L	Kovar		VAR
VPZ38SVAR	NW35CF	70	32	1.5	12.7	CF	304L	Kovar		VAR
VPZ38LASVAR	NW35CF	70	38	1.5	12.7	CF	304L	Kovar		VAR
VPZ38SVAR-LN	NW35CF	70	32	1.5	12.7	CF	316LN	Kovar		VAR
VPZ38LASVAR-LN	NW35CF	70	38	1.5	12.7	CF	316LN	Kovar		VAR
VPZ38SVAR-NM	NW35CF	70	32	1.5	12.7	CF	316LN	Tantalum	Yes	VAR
KVPZ40SVAR	KF40	55	38	1.5	18.5	KF	316L	Kovar		VAR
KVPZ50SVAR	KF50	75	38	1.5	15	KF	316L	Kovar		VAR
VPZ64SVAR	NW63CF	114	63	2	17.4	CF	304L	Kovar		VAR
VPZ64SVAR-LN	NW63CF	114	63	2	17.4	CF	316LN	Kovar		VAR
VPZ64SVAR-NM	NW63CF	114	63	2	17.4	CF	316LN	Tantalum	Yes	VAR
ISO63SVPZVAR	ISO63	95	38	1.5	12	ISO	316L	Kovar		VAR
VPZ100SVAR	NW100CF	152	89	2.5	19.9	CF	304L	Kovar		VAR
VPZ100SVAR-LN	NW100CF	152	89	2.5	19.9	CF	316LN	Kovar		VAR
VPZ100SVAR-NM	NW100CF	152	89	2.5	19.9	CF	316LN	Tantalum	Yes	VAR
ISO100SVPZVAR	ISO100	130	63	2	12	ISO	316L	Kovar		VAR
VPZ150SVAR	NW150CF	203	136	4	22.3	CF	304L	Kovar		VAR
VPZ150SVAR-LN	NW150CF	203	136	4	22.3	CF	316LN	Kovar		VAR
VPZ150SVAR-NM	NW150CF	203	136	4	22.3	CF	316LN	Tantalum	Yes	VAR
ISO160SVPZVAR	ISO160	180	89	2.5	12	ISO	316L	Kovar		VAR

Sapphire Zero Length Viewports with ITO Coating

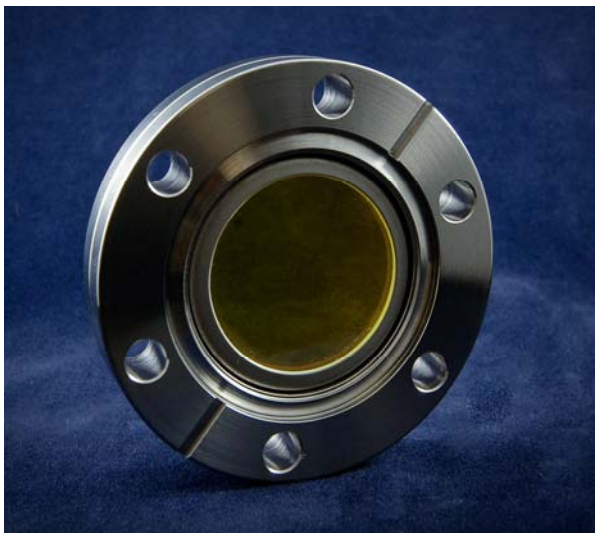
Specification	
Seal Type	Braze
Temperature	Max 450°C
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	60 /40 scratch/dig
Flatness	< 8λ



Indium Tin Oxide (ITO), a transparent semiconductor, is often used to coat glass to provide surface electrical conductivity, whilst still maintaining good transparency. This is necessary, for example, to prevent electrostatic charge build up. ITO is offered as standard on kodial and sapphire zero length viewports, but can be offered on non-standard substrates on request. The ITO coating is applied to the vacuum side of the window as standard.

Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Non-Magnetic	Coating
VPZ16SITO	NW16CF	34	15	1.5	12.7	CF	304L	Kovar		ITO
VPZ16SITO-LN	NW16CF	34	15	1.5	12.7	CF	316LN	Kovar		ITO
VPZ16SITO-NM	NW16CF	34	15	1.5	12.7	CF	316LN	Tantalum	Yes	ITO
VPZ38SITO	NW35CF	70	32	1.5	12.7	CF	304L	Kovar		ITO
VPZ38SITO-LN	NW35CF	70	32	1.5	12.7	CF	316LN	Kovar		ITO
VPZ38SITO-NM	NW35CF	70	32	1.5	12.7	CF	316LN	Tantalum	Yes	ITO
VPZ64SITO	NW63CF	114	63	2	17.4	CF	304L	Kovar		ITO
VPZ64SITO-LN	NW63CF	114	63	2	17.4	CF	316LN	Kovar		ITO
VPZ64SITO-NM	NW63CF	114	63	2	17.4	CF	316LN	Tantalum	Yes	ITO
VPZ100SITO	NW100CF	152	89	2.5	19.9	CF	304L	Kovar		ITO
VPZ100SITO-LN	NW100CF	152	89	2.5	19.9	CF	316LN	Kovar		ITO
VPZ100SITO-NM	NW100CF	152	89	2.5	19.9	CF	316LN	Tantalum	Yes	ITO
VPZ150SITO	NW150CF	203	136	4	22.3	CF	304L	Kovar		ITO
VPZ150SITO-LN	NW150CF	203	136	4	22.3	CF	316LN	Kovar		ITO
VPZ150SITO-NM	NW150CF	203	136	4	22.3	CF	316LN	Tantalum	Yes	ITO

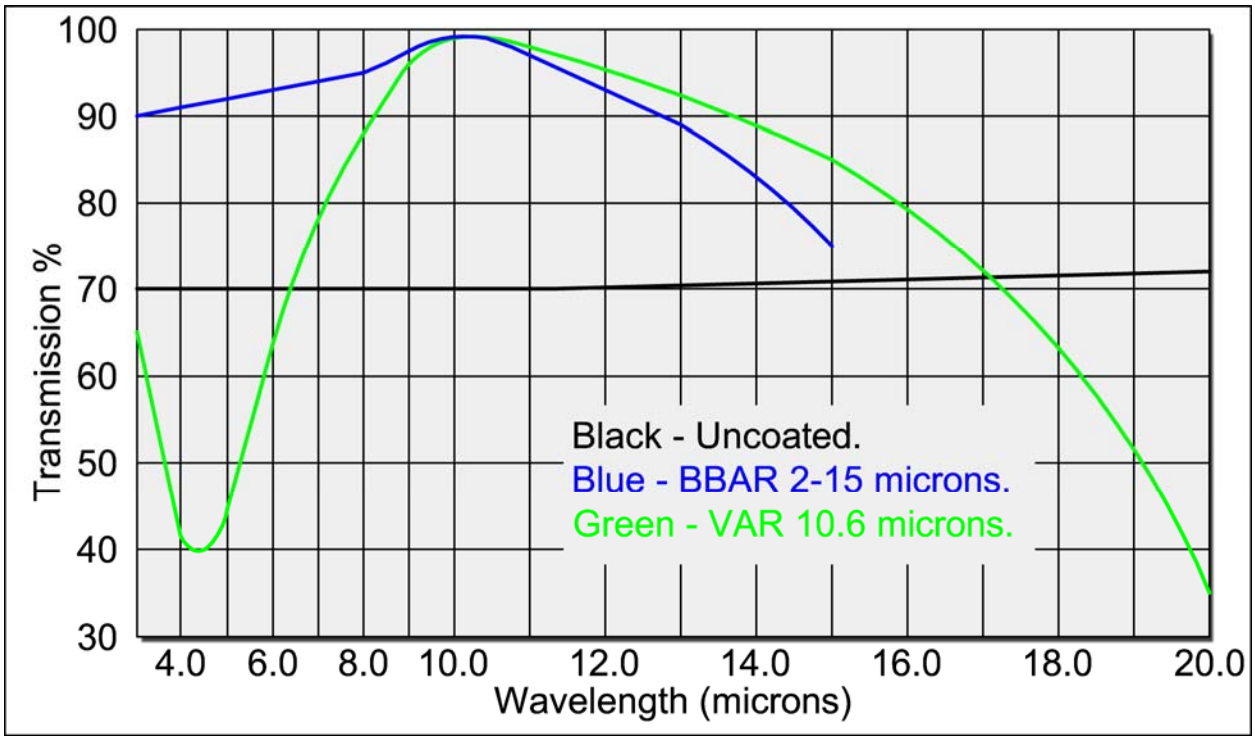
Zinc Selenide Zero Length Viewports with Anti-Reflective Coating



Torr Scientific Zinc Selenide viewports are offered in CF, ISO and KF flange styles. The clean, UHV CF versions are offered using 304L or 316LN stainless steel flanges. Non-magnetic viewports are offered as standard using 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. The rugged, bonded construction of the Zinc Selenide viewports allows bake-out to a maximum of 120 degrees C with ultra high vacuum (UHV) performance whilst the window offers extended broadband optical transmission to the extreme infra-red. A mechanically sealed range is also offered with increased temperature specification to 130 degrees C. Two types of anti-reflective coatings are available as options listed in the this section of the TSL catalogue, a 10.6 micron coating or a broadband 2 to 15 micron coating. 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.

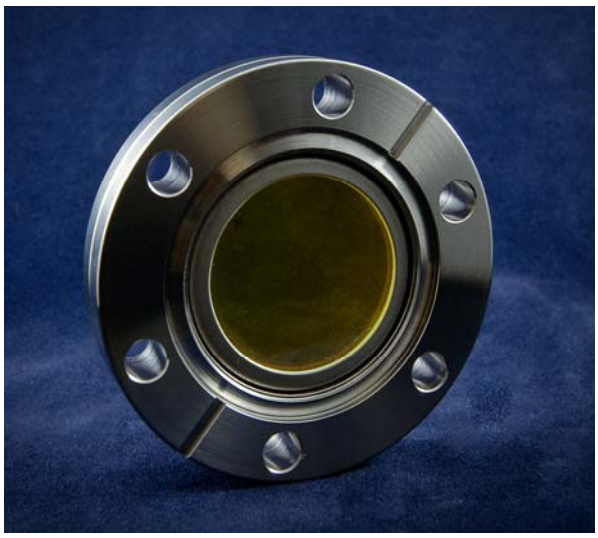
Transmission Curve– Zinc Selenide

The graph below shows typical before and after transmission effect of BBAR' and 'VAR' anti-reflective coatings on Zinc Selenide Viewports.



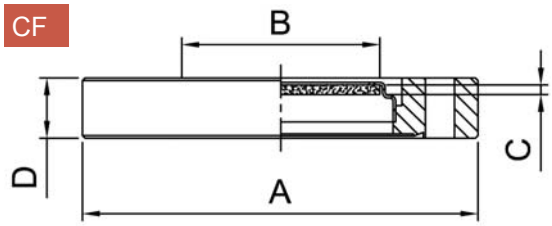
Please note that the optical transmission curves are approximations and should be used for reference only

Zinc Selenide Zero Length Viewports with Anti-Reflective Coating

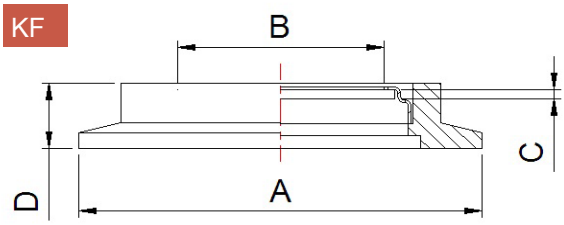


Specification	
Seal Type	Bond
Temperature	Max 120°C
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	60 /40 scratch/dig
Flatness	<2λ

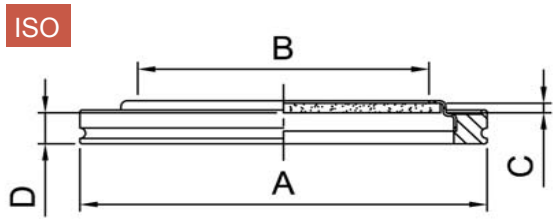
CF



KF



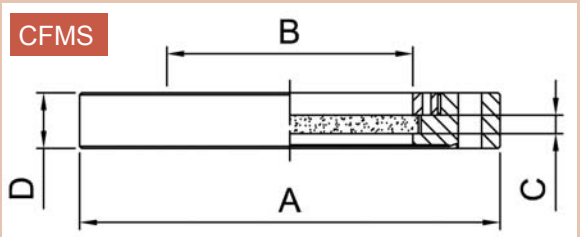
ISO

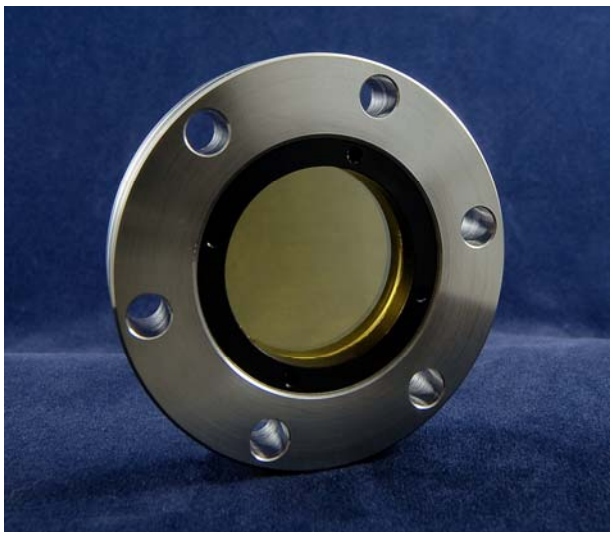


Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Non-Magnetic	Coating
BVPZ16ZnSe-10600	NW16CF	34	15	1.5	12.7	CF	304L	Kovar		VAR 10.6µ
BVPZ16ZnSe-10600-LN	NW16CF	34	15	1.5	12.7	CF	316LN	Kovar		VAR 10.6µ
BVPZ16ZnSe-10600-NM	NW16CF	34	15	1.5	12.7	CF	316LN	Tantalum	Yes	VAR 10.6µ
BKVPZ25ZnSe-10600	KF25	40	20	2	18.5	KF	316L	Kovar		VAR 10.6µ
BVPZ38ZnSe-10600	NW35CF	70	32	3	12.7	CF	304L	Kovar		VAR 10.6µ
BVPZ38LAZnSe-10600	NW35CF	70	38	3.75	12.7	CF	304L	Kovar		VAR 10.6µ
BVPZ38ZnSe-10600-LN	NW35CF	70	32	3	12.7	CF	316LN	Kovar		VAR 10.6µ
BVPZ38LAZnSe-10600-LN	NW35CF	70	38	3.75	12.7	CF	316LN	Kovar		VAR 10.6µ
BVPZ38ZnSe-10600-NM	NW35CF	70	32	3	12.7	CF	316LN	Tantalum	Yes	VAR 10.6µ
BKVPZ40ZnSe-10600	KF40	55	38	3.75	18.5	KF	316L	Kovar		VAR 10.6µ
BKVPZ50ZnSe-10600	KF50	75	38	3.75	15	KF	316L	Kovar		VAR 10.6µ
BVPZ64ZnSe-10600	NW63CF	114	63	5	17.4	CF	304L	Kovar		VAR 10.6µ
BVPZ64ZnSe-10600-LN	NW63CF	114	63	5	17.4	CF	316LN	Kovar		VAR 10.6µ
BVPZ64ZnSe-10600-NM	NW63CF	114	63	5	17.4	CF	316LN	Tantalum	Yes	VAR 10.6µ
BISO63VPZZnSe-10600	ISO63	95	38	3.75	12	ISO	316L	Kovar		VAR 10.6µ
BVPZ100ZnSe-2-15	NW100CF	152	89	6.5	19.9	CF	304L	Kovar		BBAR 2-15µ
BVPZ100ZnSe-2-15-LN	NW100CF	152	89	6.5	19.9	CF	316LN	Kovar		BBAR 2-15µ
BVPZ100ZnSe-2-15-NM	NW100CF	152	89	6.5	19.9	CF	316LN	Tantalum	Yes	BBAR 2-15µ
BISO100VPZZnSe-10600	ISO100	130	63	5	12	ISO	316L	Kovar		VAR 10.6µ
BVPZ150ZnSe-2-15	NW150CF	203	136	9.5	22.3	CF	304L	Kovar		BBAR 2-15µ
BVPZ150ZnSe-2-15-LN	NW150CF	203	136	9.5	22.3	CF	316LN	Kovar		BBAR 2-15µ
BVPZ150ZnSe-2-15-NM	NW150CF	203	136	9.5	22.3	CF	316LN	Tantalum	Yes	BBAR 2-15µ
BISO160VPZZnSe-2-15	ISO160	180	89	6.5	12	ISO	316L	Kovar		BBAR 2-15µ

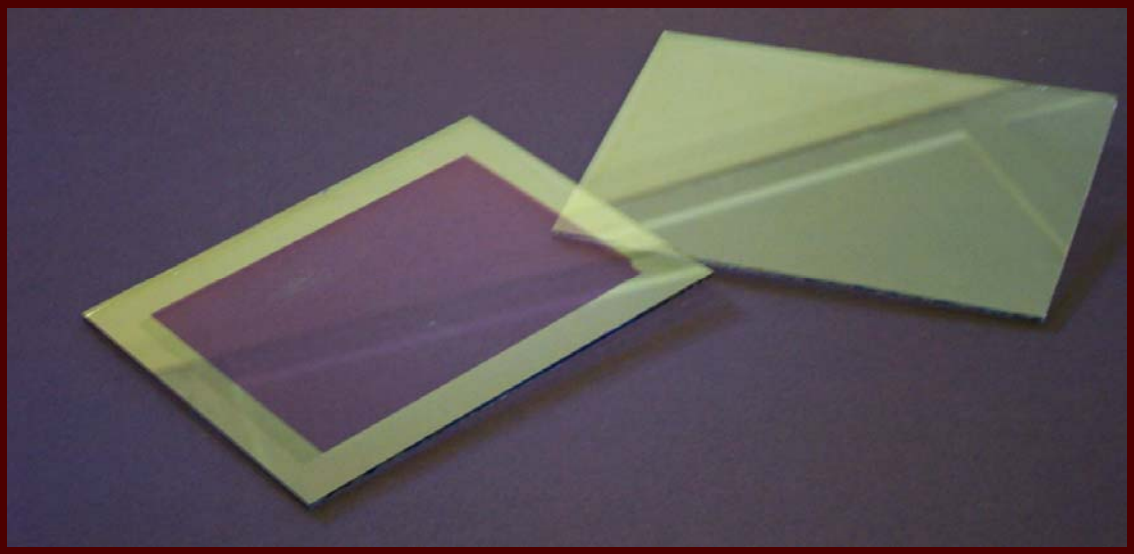
Specification	
Seal Type	Mechanically Sealed
Temperature	Max 130°C
Leak Rate	<1x10^{-10} atm-cc/sec (He)
Pressure range	<1x10^{-11} Torr
Surface quality	60 /40 scratch/dig
Flatness	<2λ

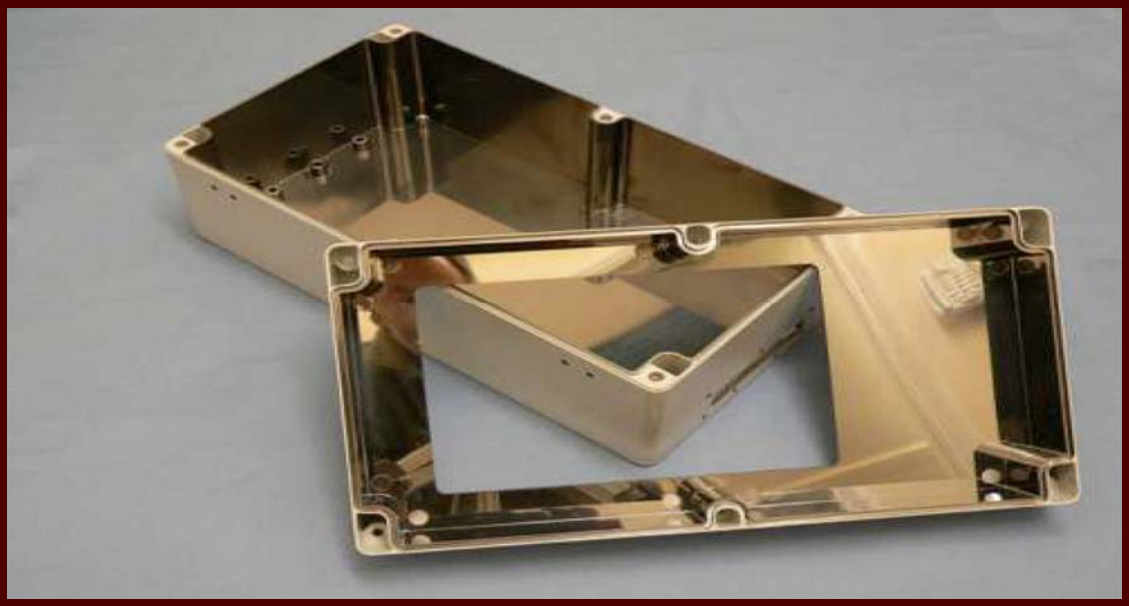
CFMS





Part Number	Flange Type	A	B	C	D	Diagram	Flange Material	Weld Ring	Non-Magnetic	Coating
VPZ38ZnSe-10600-MS	NW35CF	70	32	3	12.7	CFMS	304L	n/a		VAR 10.6µ
VPZ38ZnSe-10600-MS-NM	NW35CF	70	32	3	12.7	CFMS	316LN	n/a	Yes	VAR 10.6µ
VPZ64ZnSe-10600-MS	NW63CF	114	63	5	17.4	CFMS	304L	n/a		VAR 10.6µ
VPZ64ZnSe-10600-MS-NM	NW63CF	114	63	5	17.4	CFMS	316LN	n/a	Yes	VAR 10.6µ
VPZ100ZnSe-2-15-MS	NW100CF	152	89	6.5	19.9	CFMS	304L	n/a		BBAR 2-15µ
VPZ100ZnSe-2-15-MS-NM	NW100CF	152	89	6.5	19.9	CFMS	316LN	n/a	Yes	BBAR 2-15µ





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