Section 5

Viewports and glass components

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Section 5.1

Viewports

Introduction

Features

- Full range of window materials
- Choice of flange mounting
- Non-magnetic models available
- Variety of glass-to-metal seals

Caburn-MDC viewports are offered mounted on CF, ISO KF and LF flanges.

Standard series use 7056 glass the most commonly used window material. Sealed to a Kovar® ring, the configuration is magnetic.

Non-magnetic assemblies are also offered with 316LN flanges.

An alternative material with a greater range of transmission, magnesium fluoride is also available.

Quartz, sapphire, magnesium fluoride and Pyrex® viewports are other options. Internal viewport shutters on page 236 protect windows from evaporated materials and radiated heat.

We are pleased to offer the unique range of VacOptix® viewports. Hermetically sealed optical components with expanded transmission in all spectral regions including ultraviolet, visible and infrared.

Surface finish of viewports

The quality of polished viewport surfaces is often defined via the scratch-dig numbers, for example 80-50. The first digit defines the scratches, the second the digs.

Scratches

The scratch number defines the maximum width of a scratch in 1/10 of a μ m . So 80 corresponds to a maximum scratch width of 8μm. The scratch width is determined by visual comparison.

The combined length of the maximum size scratches on each surface of a window is not allowed to exceed one quarter of the diameter of that window.

Digs

The dig number gives the maximum point defect size in 1/100mm. A dig of 50 corresponds with 500μm. All digs greater than 100μm must be separated by at least 1mm. For a window diameter of 20 to 40mm, only two maximum digs are allowed. The sum of all dig diameters must not exceed 4 times the maximum dig diameter.

Caburn-MDC offers as a standard finish of 80-20 scratch-dig. 20-10 is available on request for additional cost, which is normally required for service below 250μm.

Suggested cleaning procedure for optics

Step 1

Blow away all dust and debris from the optical surface with an air bulb. Avoid using shop air lines because they usually contain significant amounts of oil and water. These contaminants can be detrimental on optical surfaces.

Step 2

Dampen a cotton swab or cotton ball with acetone or propanol. Gently wipe the surface with the damp cotton. Do not rub hard. Use high quality, surgical cotton balls that have been sorted to remove any with embedded abrasives. Use only paper-bodied cotton swabs. Reagent grade acetone and propanol are recommended. Drag the cotton across the surface just fast enough so that the liquid evaporates right behind the cotton. This should leave no streaks.

Step 3

For severely contaminated and dirty parts, you may need to use an optical polishing compound to remove the absorbing layers from the optic. Carefully apply the polishing solution with a cotton ball (do not use swabs) or a special polishing pad. Use very light pressure and as few strokes as possible. Wipe with a clean cotton ball dampened with distilled water and then repeat step two. If you remove the thin film coating you will destroy the optic's performance. A change in the colour indicates the loss of a coating. Examine the part carefully.

General Information

Maximum bakeout temperatures are as shown. Viewports should be baked with care. They should be covered with aluminium foil. The maximum rate of temperature change should not exceed 3°C per minute.

A conductive coating may be applied to special order.

Special note

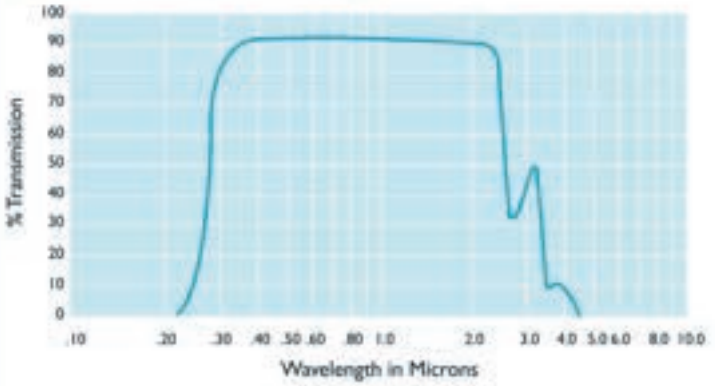
Only annealed gaskets should be used.

Viewports

Standard series introduction

Optical transmission curve glass

1mm thick reflection losses included



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

Features

- Versatile general purpose viewports for high vacuum and UHV
- Wide transmission range
- Bakeable to 400°C with good resistance to thermal shocks
- Wide variety of accessories available including lead glass shields and viewport shutters
- Non-magnetic option with 316LN flanges on request
- Magnesium fluoride option available

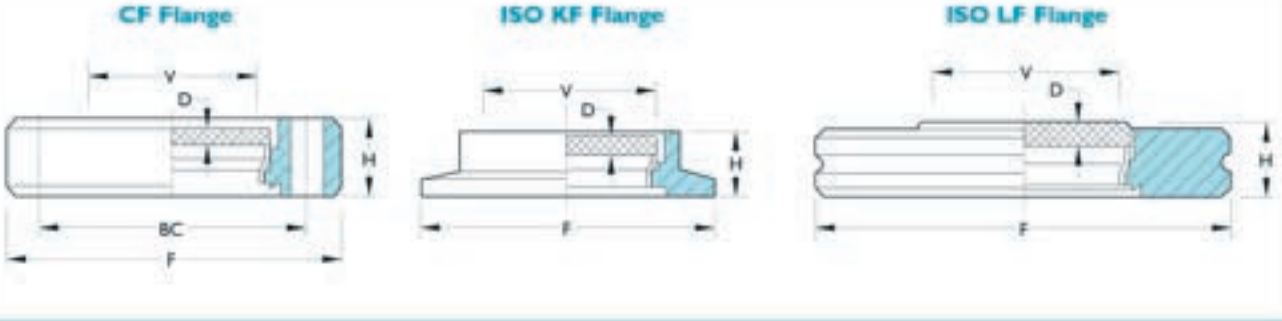
Viewport selection table and specifications

Type of viewport	Maximum bakeout temperature of flange	Maximum bakeout temperature KF / LF flange	Window	Sleeve
304ss / 7056 glass	400°C	150°C	7056 Glass (kodial)	Kovar®
Non-magnetic 316LN	400°C	–	7056 Glass (kodial)	304ss
Magnesium fluoride	250°C	150°C	MgF_2	304ss

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Viewports and glass components

Standard series

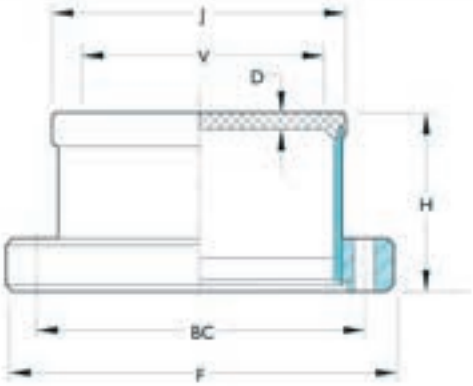


View diameter V	Flange	OD F	H	Glass thickness D	Wt kg	Reference	Part number
304 Stainless steel / Kovar® sleeve							
16	DN16CF	34	12.0	1.5	0.06	CVP-16	1210000
38	DN40CF	70	13.0	3.0	0.2	CVP-40	1210001
65	DN63CF	114	17.5	3.5	0.8	CVP-63	1210002
90	DN100CF	152	20.0	6.0	1.5	CVP-100	1210003
135	DN160CF	202	22.5	8.0	2.5	CVP-160	1210004
135	DN200CF	253	24.6	8.0	6.1	CVP-200	1210005
15	DN16KF	30	15	1.8	0.02	KVP-16	1210050
20	DN25KF	40	19	1.8	0.05	KVP-25	1210051
37	DN40KF	55	17.8	2.0	0.1	KVP-40	1210052
37	DN50KF	75	15	2.0	0.2	KVP-50	1210053
50	DN63LF	95	11.9	2.7	0.4	LVP-63	1210070
65	DN100LF	130	17.5	4.3	0.8	LVP-100	1210071
98	DN160LF	180	20.1	5.1	1.5	LVP-160	1210072

Non-magnetic viewports

Features

- Non-magnetic housekeeper seal
- Wide transmission 7056 glass (kodial)



* With stainless steel sleeves

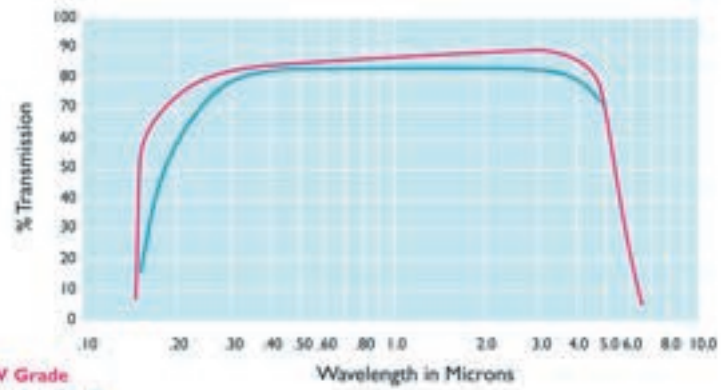
View diameter V	Flange	OD F	H	J	Glass thickness D	Wt kg	Reference	Part number
316LN Stainless steel / 304 Stainless steel sleeve								
12.7	DN16CF	34	28.4	–	1.8	0.3	CVP-16N	1210100
31.8	DN40CF	70	50.8	41.7	3.2	0.5	CVP-40N	1210101
50.8	DN63CF	114	53.8	–	4.3	1.1	CVP-63N	1210102
88.9	DN100CF	152	53.8	–	5.1	1.6	CVP-100N	1210103
136.7	DN160CF	202	69.9	–	9.5	3.0	CVP-160N	1210104

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Viewports

Sapphire introduction

Transmission v wavelength



UV Grade
Regular Grade

General specifications

Transmission range[1]	
Regular grade	0.30 to 4.00µm
UV Grade	0.2 to 4.50µm

Temperature rating[2]	
CF Flange mount	to 450°C
ISO KF Flange mount	to 150°C

[1] Transmission curves are approximations, intended for reference only, they are based on a 1mm sample thickness as tested by sapphire manufacturers

[2] Thermal gradient should not exceed 25°C/minute

Sapphire

This is a synthetic, hexagonal single crystal anisotropic material which displays substantially different physical, thermal, dielectric and optical characteristics when measured along different axes. Caburn-MDC standard sapphire viewports use material with 90° crystal orientation, i.e. crystal orientation parallel to window surface. Viewports with crystal orientation parallel to optical axis, or 0° orientation, are available on request at additional cost. Most material grades are available up to 49mm.

Grades

All viewports up to 25mm in diameter are offered with UV grade sapphire; those exceeding 25mm diameters are offered with regular grade materials. UV grade material is available on request at additional cost.

Note Limitations in today's crystal growth technology make it difficult to guarantee constant transmission performance at wavelengths below 0.25 microns.

Surface finish

Poor surface finish can contribute as much as 10% to overall transmission losses. All viewports are supplied with flat faces which have been finished to standards suitable for most applications. Caburn-MDC's standard finish is a 50-20 scratch-dig. Other finishes are available on request at additional cost. The optics industry typically recommends a 20-10 scratch-dig optical finish for service below 0.25µm.

Crystal orientation

Crystal orientation of Caburn-MDC sapphire viewports is normal to optical axis or 90° orientation. Assemblies with crystal orientation parallel to optical axis or 0° orientation, are available on request at additional cost.

Features

- Sapphire single crystal
- 90° crystal orientation
- 50-20 Scratch-dig

Viewport coatings

Special order anti-reflection coatings can be applied to windows with view diameters greater than or equal to 25.4mm. Note that one window surface is recessed within the viewport's tubular metal mount which will produce shadowing on that side of the window. Caburn-MDC guarantees uniform AR coating over 80% of the window's clear aperture or view diameter. High temperature braze cycles (800°C) require that all coatings be applied after brazing.

Single layer Narrow band Anti-reflection SLAR

SLAR coating is available for sapphire or quartz window substrates. This coating may be tailored and optimized for specific wavelengths between 200nm and 2200nm, with reflection losses less than or equal to 0.5% per surface for either substrate material.

Multi-layer Broad band Anti-reflection MLAR

MLAR coating is available for sapphire or quartz window substrates. This coating is optimized for transmission over the entire range of wavelengths from 450nm to 800nm, with reflective losses at less than or equal to 1.0% per surface for either substrate material.

All dimensions are nominal in millimetres unless specified - Weights given are approximate

CF Flanges

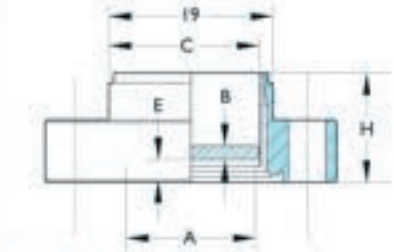


Figure 1

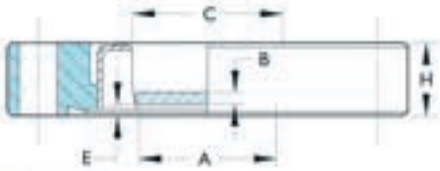


Figure 2

Grade	Flange	Nominal size	Figure	View diameter A	B	C	E	H	Wt kg	Reference	Part number
UV	DN16CF	9	2	8.9	2.0	9.6	1.6	7.2	0.04	VP-0465	9712007
UV	DN16CF	15	1	14.9	2.7	16.0	1.6	12.7	0.04	VP-0755	9712000
UV	DN40CF	18	2	17.5	2.03	19.6	2.0	12.7	0.3	VP-0695	9712001
UV	DN40CF	24	2	23.8	2.03	25.9	2.0	12.7	0.3	VP-1005	9712002
Reg	DN40CF	37	2	36.6	2.39	38.6	2.5	12.7	0.3	VP-1445	9712005
Reg	DN63CF	50	2	49.3	2.39	51.3	2.5	17.3	1.1	VP-2005	9712004

KF Flanges

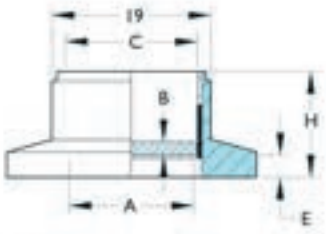


Figure 3

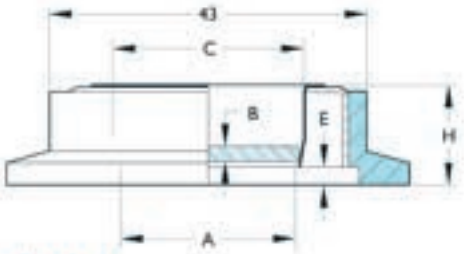


Figure 4

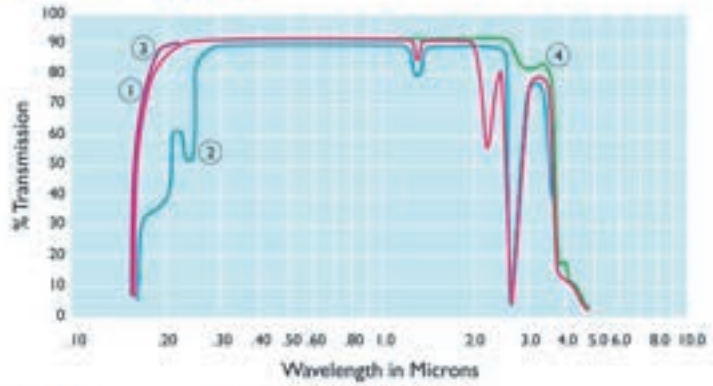
Grade	Flange	Nominal size	Figure	View diameter A	B	C	E	H	Wt kg	Reference	Part number
UV	DN16KF	15	3	15.0	1.57	16.0	3.3	12.7	0.1	KVP-075S	9713000
UV	DN40KF	18	4	17.5	2.03	19.6	3.3	12.7	0.2	KVP-150S	9713001
UV	DN40KF	24	4	23.9	2.03	25.9	3.3	12.7	0.2	KVP-150-15	9713002

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Viewports

Fused silica introduction

Transmission v wavelength



1 UV grade
2 Regular grade
3 Excimer UV
4 Infrared

General specifications

Transmission range[1]

Fused quartz Discontinued	0.30 to 2.50µm
Base ultraviolet UV	0.20 to 2.00µm
Deep ultraviolet DUV-200	0.20 to 2.00µm
Excimer ultraviolet EUV-185	0.185 to 2.20µm
Infra-red, low OH On request	0.185 to 2.20µm

Material	Inclusion class number	Total inclusion cross-section	Maximum inclusion cross-section	Index homogeneity grade	ppm
UV	2	0.10-0.25mm²	0.50mm	F	≤5
DUV-200	0	0.00-0.03mm²	0.10mm	A	≤1
EUV-185	0	0.00-0.03mm²	0.10mm	C	≤2
Infrared	0	0.00-0.03mm²	0.20mm	A	≤5

Temperature rating[2]

CF Flange mount	200°C[3]
ISO KF Flange mount	150°C

[1] Transmission curves are approximations, intended for reference only, they are based on a 10mm sample thickness as tested by quartz manufacturers

[2] Thermal gradient should not exceed 25°C/minute

[3] Lead-silver braze alloy melts at 305°C

Description

Caburn-MDC fused silica viewports are designed and rated for high and ultra-high vacuum applications. They are constructed using vacuum grade materials including high purity silicon dioxide, 304 stainless steel and vacuum tube-grade braze alloys.

Fused silica is a polycrystalline, isotropic material with no crystal orientation. Its physical, thermal, dielectric and optical properties are uniform in all directions of measurement.

Conventional fused quartz is suitable for basic non-demanding optical applications. Impurities in fused quartz cause a blue-violet fluorescence when exposed to ultraviolet radiation at 253.7µm. This fluorescence is not evident in synthetic fused silica, which is manufactured by flame hydrolosis of silicon tetrachloride.

Caburn-MDC offers three ultaviolet grades of fused silica. A base ultaviolet and two deep ultraviolet grades, DUV-200 and EUV-185.

Features

- Synthetic fused silica
- Standard and zero length
- 40-20 scratch-dig
- Non-coated optics
- Six sizes available

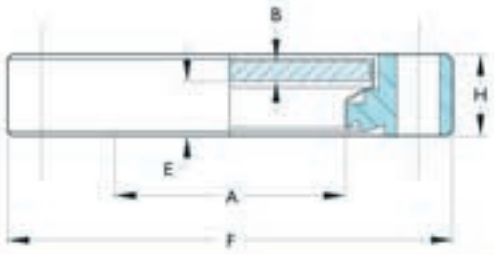
The base UV grade material is suitable for all but the most demanding optical applications and certified to meet ≥80%/cm @185nm external transmittance. DUV-200 fused silica is equivalent to Suprasil-1® and similar to the base grade with the exception of inclusion specifications. EUV-185 is an excimer grade window material which offers excellent performance for excimer-UV laser applications. This material is certified to meet ≥85%/cm @ 185nm external transmittance.

Infrared fused silica windows with low 'OH' content can be quoted for applications requiring IR transmission to about 3600nm. This material has less than 1ppm OH content which eliminates the typical absorption band found in other materials.

Fused silica viewports are preferred over glass viewports because of their transparency to ultraviolet radiation. Other advantages include a higher abrasion resistance and a low coefficient of thermal expansion, making them very resistant to thermal shock. Poor surface finish can contribute as much as 10% overall transmission losses. All viewports are supplied with flat faces which have been finished to standards suitable for most applications. Caburn-MDC standard finish for fused silica viewports is 40-20 scratch-dig. Other finishes are available on request at additional cost. For Deep-UV grade materials, the optics industry typically recommends a 20-10 scratch-dig optical finish for service below 0.25 microns.

All dimensions are nominal in millimetres unless specified - Weights given are approximate

CF Flanges



Zero length fused silica viewports Ultraviolet

Window material	CF flange	Nominal size	View dia. A	B	E	F	H	Wt kg	Reference	Part number
Fused silica	DN16CF	20	16.0	2.5	4.3	34	7.4	0.3	VP-UV-C16	9722013-1
Fused silica	DN40CF	38	35.6	3.3	8.9	70	12.7	0.4	VP-UV-C40	9722005-1
Fused silica	DN63CF	63	68.3	6.4	10.4	114	17.3	1.1	VP-UV-C63	9722007-1
Fused silica	DN100CF	102	98.6	6.4	13.0	152	19.8	1.4	VP-UV-C100	9722009-1
Fused silica	DN160CF	152	136.7	9.7	12.2	203	22.4	1.6	VP-UV-C160	9722011-1
Fused silica	DN200CF	203	197.6	9.7	13.5	254	24.6	2.7	VP-UV-C200	9722012-1

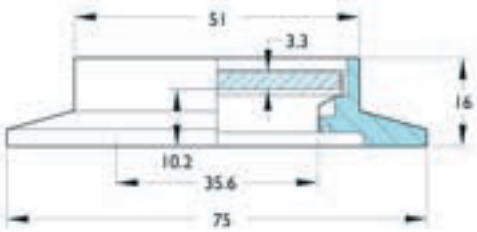
Zero length fused silica viewports Deep ultraviolet

Window material	CF flange	Nominal size	View dia. A	B	E	F	H	Wt kg	Reference	Part number
Fused silica	DN16CF	16	16.0	2.5	4.3	34	7.4	0.3	VP-DUV-200-C16	9722213
Fused silica	DN40CF	38	35.6	3.3	8.9	70	12.7	0.4	VP-DUV-200-C40	9722205
Fused silica	DN63CF	63	68.3	6.4	10.4	114	17.3	1.1	VP-DUV-200-C63	9722207
Fused silica	DN100CF	102	98.6	6.4	13.0	152	19.8	1.4	VP-DUV-200-C100	9722209

Zero length fused silica viewports Excimer ultraviolet

Window material	CF flange	Nominal size	View dia. A	B	E	F	H	Wt kg	Reference	Part number
Fused silica	DN16CF	16	16.0	2.5	4.3	34	7.4	0.3	UV-EUV-185-C16	9722300
Fused silica	DN40CF	38	35.6	3.3	8.9	70	12.7	0.4	UV-EUV-185-C40	9722301
Fused silica	DN63CF	63	68.3	6.4	10.4	114	17.3	1.1	UV-EUV-185-C63	9722302

KF Flanges



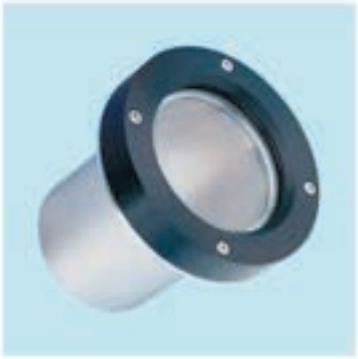
Zero length fused silica viewports Ultraviolet

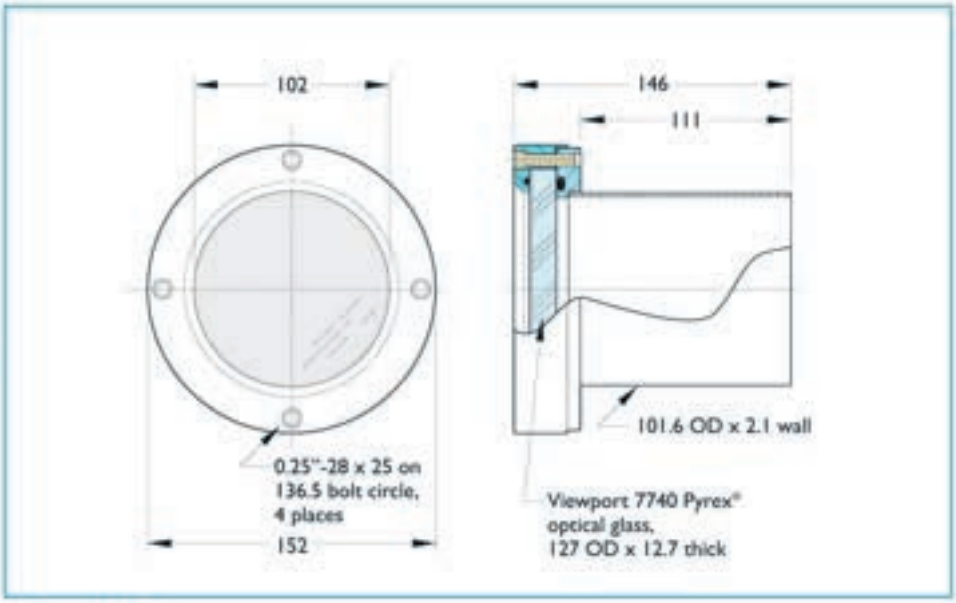
Window material	Nominal size	View dia. A	Wt kg	Reference	Part number
DN50KF	38	35.6	0.2	KVP-150Q	9713002

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Viewports

Weldable Pyrex®





Features

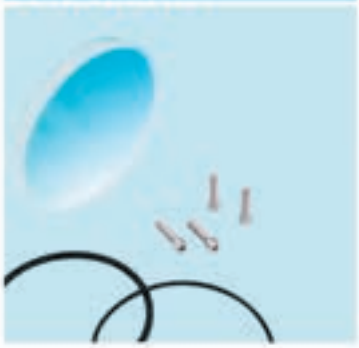
- Weld neck, 101.6mm OD
- Pyrex® 7740 borosilicate optical glass
- 100mm diameter nominal viewing area
- Type 304 stainless steel mounting
- Viton® O-ring seal
- Replaceable glass

Description

Economical visual quality viewport used on high vacuum chambers. Weldable configuration allows installation on a custom built stainless steel chamber. The replaceable viewport glass is captured between two elastomer O-rings. The viewport can be easily disassembled by removing four screws from the retainer ring.

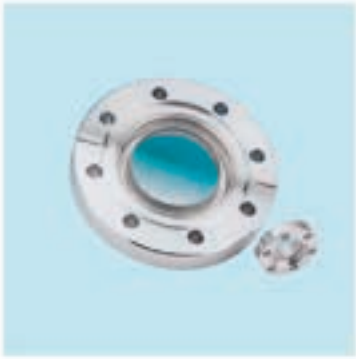
Description	Wt kg	Reference	Part number
Pyrex viewport with 102mm OD weld neck	1.5	PVP-4	450010

Spare parts



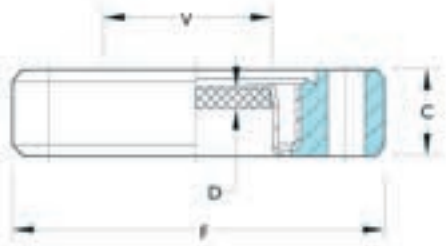
Description	Wt kg	Reference	Part number
Replacement glass, 7740 pyrex optical 127mm OD	0.5	PRG-4	045010
Bolt, socket head, stainless steel, 0.25"-28 x 1" long (pack of 4)	0.1	BSPW	190166
O-ring, glass-to-flange	0.1	VO-2-346	041346
O-ring, glass-to-retainer	0.1	VO-2-243	041243

All dimensions are nominal in millimetres unless specified - Weights given are approximate

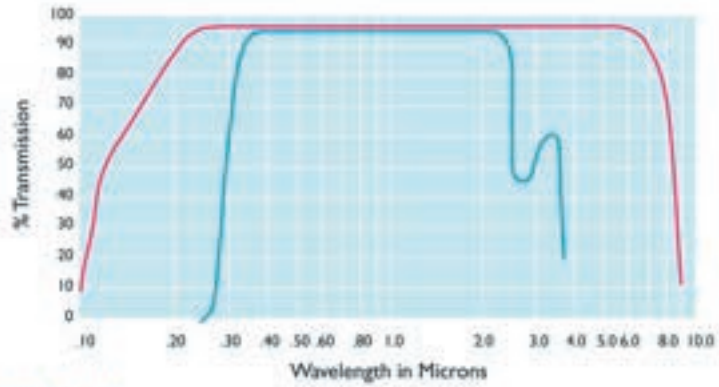


Features

- UHV compatible
- Bakeable to 300°C
- Wider transmission range than the standard series



Transmission v wavelength

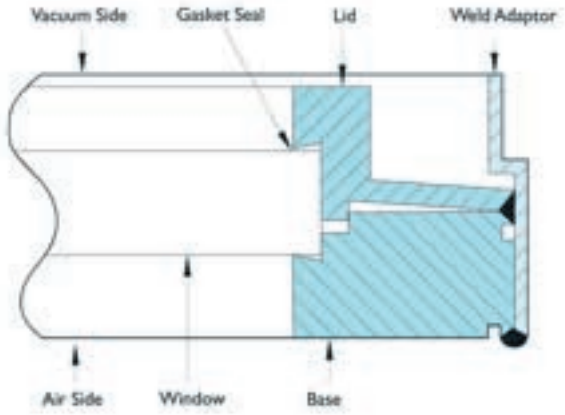


Magnesium fluoride
7056

View diameter V	Flange	OD F	Flange thickness C	Magnesium fluoride thickness D	Reference	Part number
20	DN40CF	70	12.7	2	CVPMG22	1210200
38	DN40CF	70	12.7	3	CVPMG40	1210201

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Unique VacOptix® hermetic seal design



General specifications

Transmission range[1]

See charts opposite

Temperature rating[2]

CF to 200°C

[1] Transmission charts are for reference only

[2] Thermal gradient should not exceed 10°C/minute

[3] VacOptix® is a registered trademark of Insulator Seal – patent pending

Features

- Extended UV-IR range materials
- Optional AR coatings
- VacOptix®[3] sealed optics

Calcium fluoride

Cleartran

Magnesium fluoride

Zinc selenide

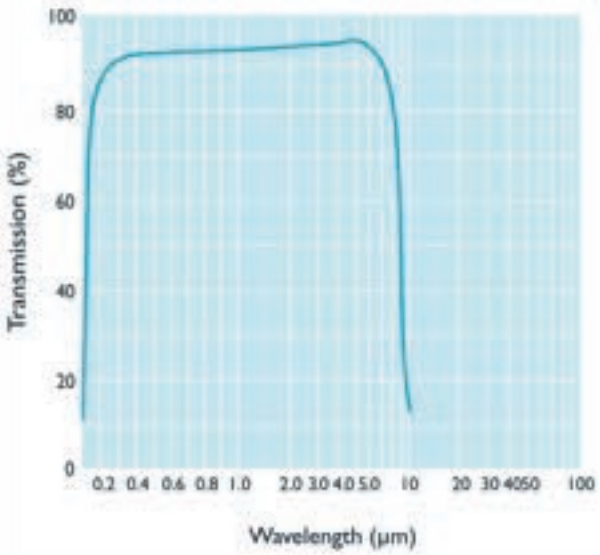
VacOptix® is a breakthrough in hermetic seal technology. It is a patented method for making optical assemblies with virtually any glass or crystalline material. This new technique, VacOptix®, allows Caburn-MDC to offer a wider range of hermetically sealed optical components with expanded transmission in all spectral regions including ultraviolet, visible and infrared.

VacOptix® seal technology has been developed for service in such demanding environments as corrosive chemical, cryogenic and ultra-high vacuum. Only non-magnetic, low vapour pressure materials such as 304 stainless steel hardware and aluminum gaskets are employed to seal all available window materials.

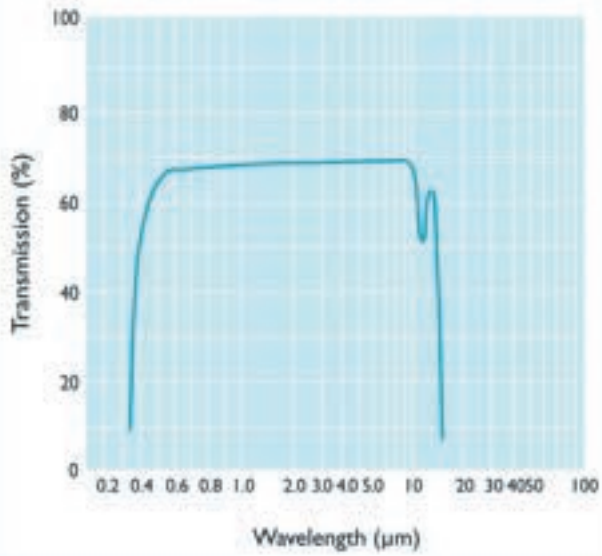
Plane parallel windows are offered without anti-reflective coatings. Plano convex, plano concave and anti-reflective coatings are available on request at additional cost.

For special optical, chemical, pressure, cryogenic or vacuum needs please call technical sales. VacOptix®, hermetic seal technology designs are no longer constrained with the limitations of prior sealing techniques which are unable to produce reliable hermetic seals of such material diversity.

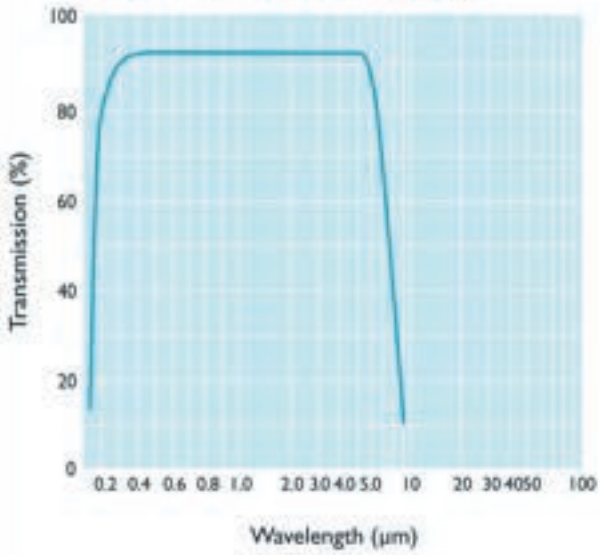
Calcium fluoride (CaF_2)



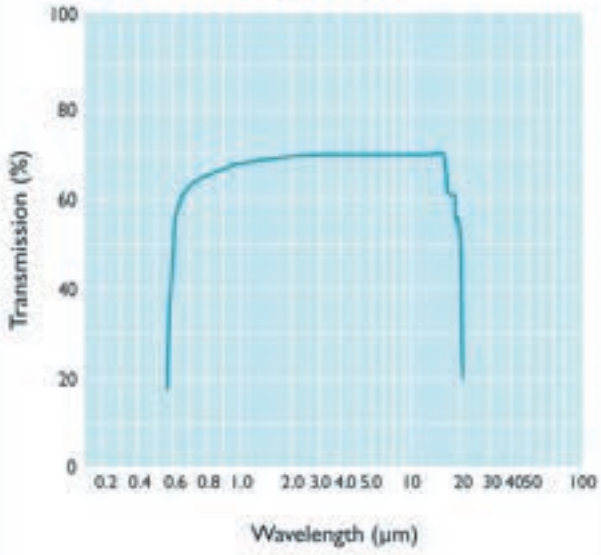
Cleartran™



Magnesium fluoride (MF_2)



Zinc selenide (ZnSe)



Viewports

Standard VacOptix® viewports

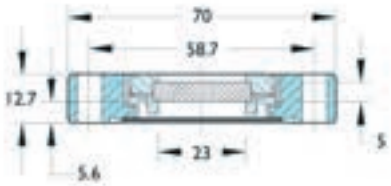


Figure 1

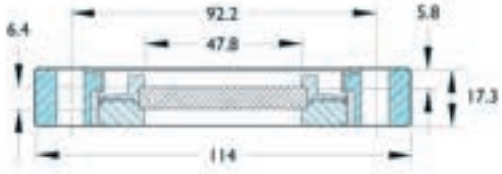


Figure 2

Material	Figure	Flange	Wt kg	Reference	Part number
Magnesium fluoride	1	DN40CF	0.7	VOMF-C40	9792054
Magnesium fluoride	2	DN63CF	1.1	VO2MF-C63	9792056
Calcium fluoride	1	DN40CF	0.7	VOCF-C40	9792094
Calcium fluoride	2	DN63CF	1.1	VO2CF-C63	9792096
Cleartran	1	DN40CF	0.7	VOCL-C40	9792724
Cleartran	2	DN63CF	1.1	VO2CL-C63	9792726
Zinc selenide	1	DN40CF	0.7	VOZS-C40	9792884
Zinc selenide	2	DN63CF	1.1	VO2ZS-C63	9792286

All dimensions are nominal in millimetres unless specified - Weights given are approximate

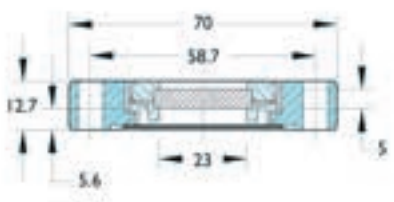


Figure 1

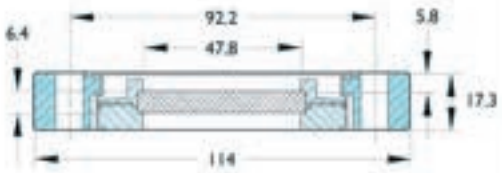


Figure 2

Material	Figure	Flange	Coating	Wt kg	Reference	Part number
Cleartran	1	DN40CF	8-12 µm	0.7	CVOCE12000-C40	9792731
Cleartran	2	DN63CF	8-12 µm	1.1	CVO2CE12000-C63	9792733
Cleartran	1	DN40CF	10.6 µm	0.7	CVOCE10600-C40	9792751
Cleartran	2	DN63CF	10.6 µm	1.1	CVO2CE10600-C63	9792753
Zinc selenide	1	DN40CF	8-12 µm	0.7	CVOZS12000-C40	9792891
Zinc selenide	2	DN63CF	8-12 µm	1.1	CVO2ZS12000-C63	9792893
Zinc selenide	1	DN40CF	10.6 µm	0.7	CVOZS10600-C40	9792901
Zinc selenide	2	DN63CF	10.6 µm	1.1	CVO2ZS10600-C63	9792903

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Viewports

Shutter accessories

UHV Series

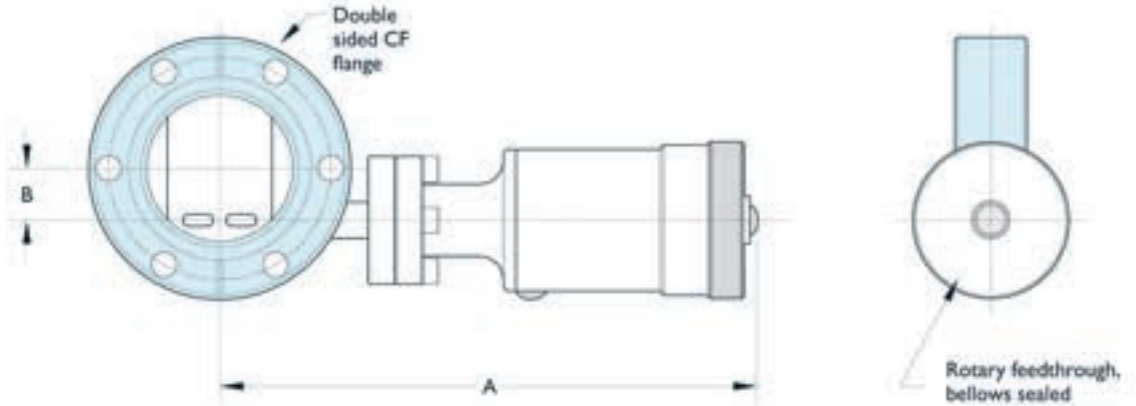
Description

VPS Series rotary viewport shutters provide quick and efficient shielding for standard viewports. These shutters are ideally suited for service in high and ultrahigh vacuum coating applications. They are swing-type, pivoting shutters that are mounted between viewports and chamber port flanges. The shape of each shutter has been designed to maximize its aperture into a standard tubed port. The actual amount of shutter swing will be dependent on the mating chamber port's tube diameter.

The table below gives the maximum swing angle for shutters mounted on Caburn-MDC half-nipples fitted with standard CF metal seal flanges with corresponding tube diameters. To provide maximum shielding of viewports, each shutter body has a step machined to match the shape and contour of the shutter's flap. Actuation of the shutter is provided through an MDC bellows sealed rotary drive. Improved design features include all stainless steel body allowing for bakeout up to 230°C. A positive click-stop action has also been added to the rotary driver that allows for partial opening of the shutter's flapper plate between the fully opened and fully closed positions. Shutter path must be unobstructed during actuation as shutter mechanism can be damaged when shutter is forced beyond a clear and unobstructed travel path, such as smaller tube diameters.

Features

- 100% viewport shielding
- Double-sided flange mount
- CF metal seal interface
- Actuated with bellows sealed rotary feedthrough
- All stainless steel construction
- Four flange sizes
- Bakeable to 200°C

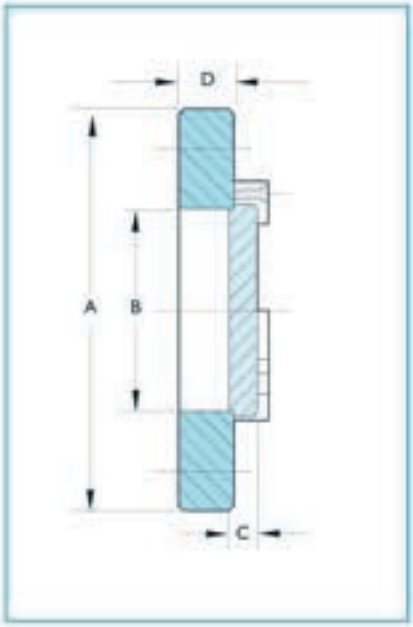


- Viewport shutter flange is installed between viewport and chamber flanges
- Positive detent for travel stops and positioning
- Bolt holes straddle vertical centreline on flange sizes 69.9 to 152.4mm – bolt holes located on vertical centreline on flange size 203.2mm

Nominal flange	Flange OD	Flange thickness	A	B	Shutter angle	Wt kg	Reference	Part number
DN40CF	70	19	142	13.7	85°	0.7	VPS-275	454000
DN63CF	114	17	180	27.2	72°	1.4	VPS-450	454001
DN100CF	152	20	188	45.2	75°	2.0	VPS-600	454002
DN160CF	203	22	207	63.2	78°	4.3	VPS-800	454003

Refer to individual double-sided flange size for mounting hardware

All dimensions are nominal in millimetres unless specified - Weights given are approximate



Features

- Lead equivalent see below
- For radiation protection
- RWB 46 glass contains 48% Pb and 15% Ba
- Easily mountable to viewports fitted with CF flanges
- Bakeable to 250°C
- Lead glass screens are not leak tight and must be used in conjunction with vacuum viewports
- Use bolt sets for double sided flanges see corresponding flange size accessories

Lead equivalent

6mm thickness		
	100-110KV	1.86mm
	150KV	1.80mm
	200KV	1.50mm

Port flange	OD A	View B	Glass thickness C	Shield thickness D	Wt kg	Reference	Part number
DN40CF	70	39	6	10	0.5	LG-40	1210300
DN63CF	114	66	6	10	1.4	LG-63	1210301
DN100CF	152	89	6	10	2.5	LG-100	1210302
DN160CF	203	139	6	10	5.5	LG-160	1210303

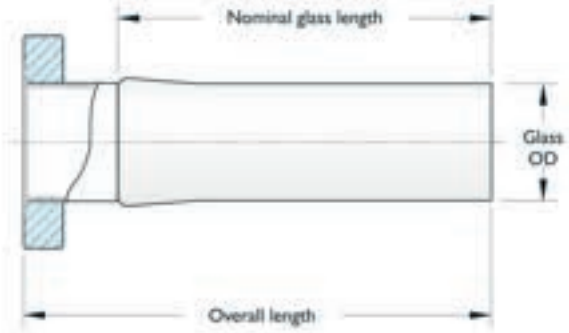
All dimensions are nominal in millimetres unless specified - Weights given are approximate

Glass components

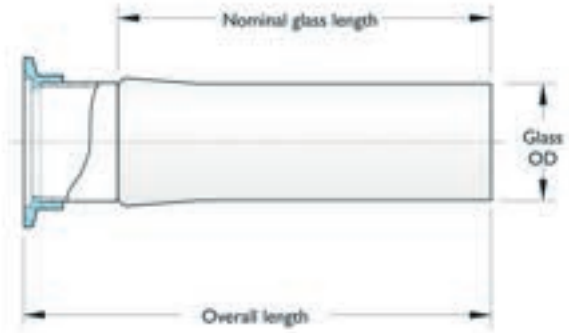
Glass to metal adaptors introduction

UHV and HV vacuum series

CF Flange



KF Flange



- Nominal lengths ±3mm

Features

- 7740 Pyrex® or optional type 7052 glass
- Type 304ss flange material
- Metal or O-ring seal geometries
- Kovar® or stainless steel sleeve
- Custom lengths available on request
- Other configurations available on request

Description

Caburn-MDC glass to metal adaptors facilitate the attachment of glass accessories to metal high vacuum systems and to attach UHV flange mounted devices to glass systems.

Standard adaptors are offered with a choice of 7740 Pyrex® to Kovar® sleeve or 7740 Pyrex® to Type 304 stainless steel sleeve non-magnetic combination. Adaptors with Kovar® sleeve material have a lower temperature limitation of -80°C.

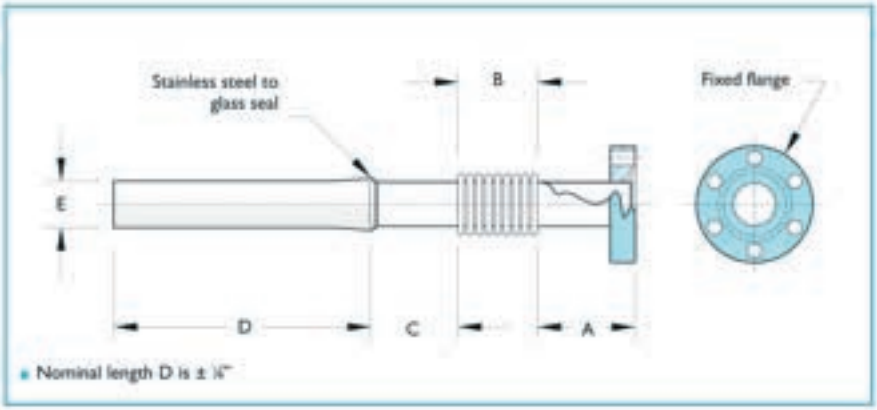
CF flange mounted units are bakeable to 400°C and useable to below 10^{-10} mbar. Kwik-Flange™ mounted adaptors are bakeable to 200°C intermittent and can be used at 150°C sustained temperature. Overall lengths and glass lengths for all glass components are nominal ±3mm.

All sizes are also available with 7052 glass.

Glass components

Bellows adaptors

CF to glass



* Nominal length D is ± ¼"

Features

- Excellent vibrational absorption
- Ideal for high temperature and cryogenics
- 7740 Pyrex®
- 321ss bellows material
- 304ss flange material
- 300°C maximum bakeout

Flange size	A	Bellows B[1]	C	D	E	Maximum bend	Wt kg	Reference	Part number
DN16CF	22.0	50	19	76	6.4	180°	0.2	FGA-025-2	466000
DN16CF	22.0	25	19	76	9.5	90°	0.2	FGA-037-1	466007
DN16CF	22.0	76	19	76	9.5	180°	0.2	FGA-037-3	466008
DN16CF	28.4	25	25	76	12.7	45°	0.2	FGA-050-1	466001
DN16CF	28.4	76	25	76	12.7	180°	0.2	FGA-050-3	466002
DN40CF	28.4	25	25	76	19.1	30°	0.7	FGA-075-1	466003
DN40CF	28.4	76	25	76	19.1	90°	0.7	FGA-075-3	466004
DN40CF	28.4	25	25	76	38.1	15°	1.0	FGA-150-1	466005
DN40CF	28.4	76	25	76	38.1	60°	1.0	FGA-150-3	466006

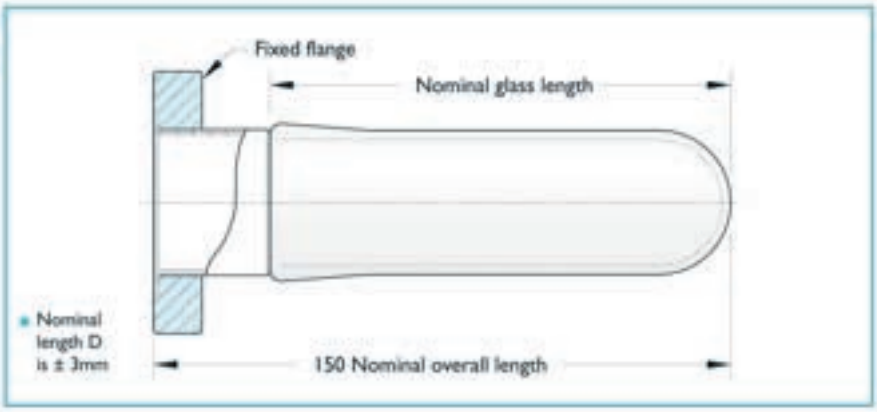
[1] Allows up to 50% expansion and 20% compression of bellows length

Glass components

Sealed-off

CF

300°C maximum bakeout



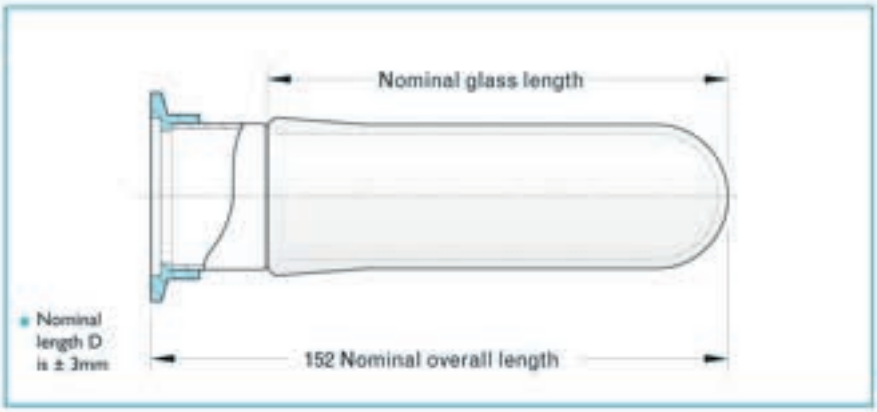
Features

- 7052 Glass
- Kovar® sleeve material
- Optional Pyrex® to stainless steel
- 300°C maximum bakeout
- 304ss non-rotatable flange
- Custom lengths available on request
- Other configurations available on request

Nominal ID	Flange size	Flange OD	Nominal glass length	Wt kg	Reference	Part number
14	DN16CF	34	111	0.2	SEG-075	463000
33	DN40CF	70	121	0.5	SEG-150	463002
55	DN63CF	114	108	0.8	SEG-250	463004
93	DN100CF	152	98	1.4	SEG-400	463006
139	DN160CF	203	98	2.3	SEG-600	463008

ISI KF

200°C maximum bakeout



Features

- 7052 Glass
- Kovar® sleeve material
- Optional Pyrex® to stainless steel
- 200°C maximum bakeout
- 304ss flange
- Custom lengths available on request
- Other configurations available on request

Nominal ID	Flange size	Flange OD	Nominal glass length	Wt kg	Reference	Part number
14	DN16KF	30	111	0.2	KSEG-075	463020
21	DN25KF	40	111	0.3	KSEG-100	463021
33	DN40KF	55	121	0.5	KSEG-150	463022
46	DN50KF	75	108	0.5	KSEG-200	463023

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Glass components

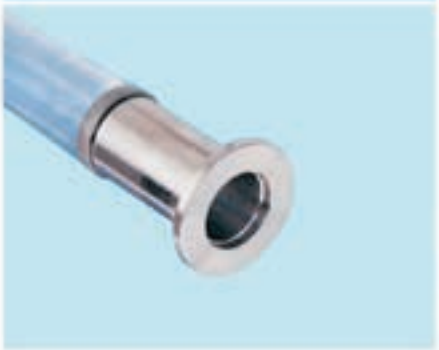
Glass to metal adaptors

Kovar® to 7740 Pyrex® — CF — 304ss to 7740 Pyrex®

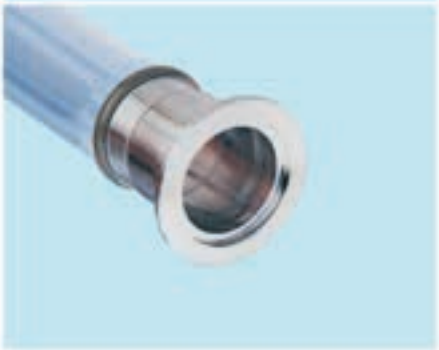
Dimensions given in the table below apply to both the **Kovar®** adaptors on the left and the **304 stainless steel** adaptors on the right.

Part number	Reference	Kovar®-to-Pyrex® overall length	Nominal glass OD	Wall thickness	Flange	304ss-to-Pyrex® overall length	Reference	Part number
461000	GA-012P	136	3.1	0.8	DN16CF	124	GA-012P-S	460000
461001	GA-018P	136	4.7	0.8	DN16CF	124	GA-018P-S	460001
461002	GA-025P	136	6.3	1.0	DN16CF	124	GA-025P-S	460002
461003	GA-031P	136	7.9	1.0	DN16CF	124	GA-031P-S	460003
461004	GA-037P	136	9.5	1.0	DN16CF	124	GA-037P-S	460004
461005	GA-050P	136	12.7	1.3	DN16CF	124	GA-050P-S	460005
461006	GA-062P	136	15.9	1.3	DN16CF	124	GA-062P-S	460006
461007	GA-075P	136	19.0	1.3	DN16CF	133	GA-075P-S	460007
461010	GA-112P	136	28.6	1.5	DN40CF	124	GA-112P-S	460010
461011	GA-125P	136	31.8	1.8	DN40CF	124	GA-125P-S	460011
461023	GA-137P	136	34.9	2.0	DN40CF	124	GA-137P-S	460012
461012	GA-150P	136	38.1	2.0	DN40CF	124	GA-150P-S	460013
461014	GA-225P	147	57.1	2.5	DN63CF	136	GA-225P-S	460017
461015	GA-250P	190	63.5	2.5	DN63CF	143	GA-250P-S	460018
–	–	–	82.6	2.5	DN100CF	162	GA-325P-S	460021
–	–	–	88.9	2.5	DN100CF	162	GA-350P-S	460022
–	–	–	95.3	2.5	DN100CF	162	GA-375P-S	460023
461020	GA-400P	257	101.6	2.5	DN100CF	162	GA-400P-S	460024
461022	GA-600P	270	152.4	3.5	DN200CF	210	GA-600P-S	460026

Kovar® to 7740 Pyrex® — ISO KF — 304ss to 7740 Pyrex®



Dimensions given in the table below apply to both the **Kovar®** adaptors on the left and the **304 stainless steel** adaptors on the right.



Part number	Reference	Kovar®-to-Pyrex® overall length	Nominal glass OD	Wall thickness	Flange	304ss-to-Pyrex® overall length	Reference	Part number
461040	KGA-075P	146	19.0	1.3	DN16KF	133	KGA-075P-S	460040
461041	KGA-100P	140	25.4	1.5	DN25KF	124	KGA-100P-S	460041
461042	KGA-150P	140	38.1	2.0	DN40KF	127	KGA-150P-S	460042
461043	KGA-200P	152	50.8	2.0	DN50KF	139	KGA-200P-S	460043

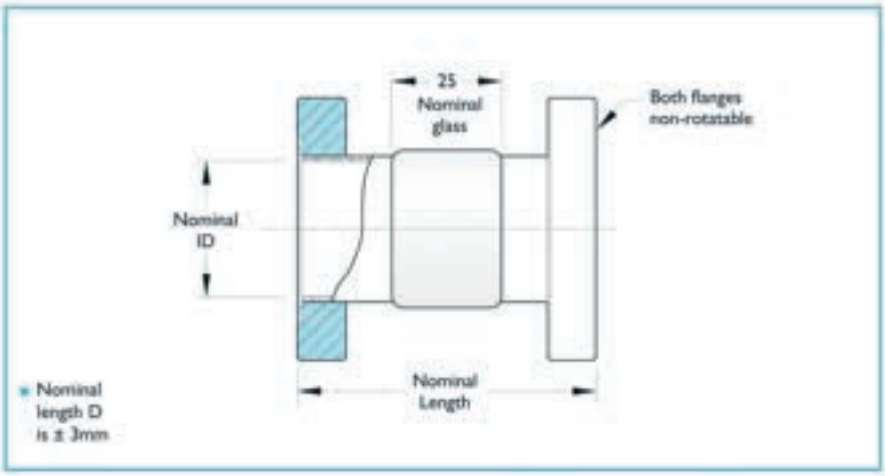
All dimensions are nominal in millimetres unless specified - Weights given are approximate

Glass components

Double ended

CF

400°C maximum bakeout



Features

- 7052 Glass
- Kovar sleeve material
- Optional Pyrex® to stainless steel
- 400°C maximum bakeout
- 304ss non-rotatable flange
- Custom lengths available on request
- Other configurations available on request

Nominal ID	Flange size	Flange OD	Nominal length	Wt kg	Reference	Part number
14	DN16CF	34	76	0.2	DEG-075	462000
33	DN40CF	70	76	0.3	DEG-150	462002
55	DN63CF	114	130	1.0	DEG-250	462004
94	DN100CF	152	133	2.0	DEG-400	462006
140	DN160CF	203	136	3.2	DEG-600	462008

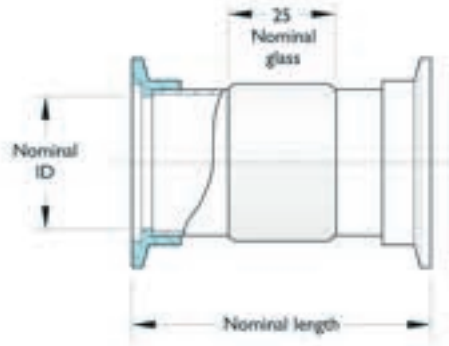
All dimensions are nominal in millimetres unless specified - Weights given are approximate

Glass components

Double ended

ISO KF

200°C maximum bakeout



* Nominal length D is ± 3mm

Features

- 7052 Glass
- Kovar sleeve material
- Optional Pyrex® to stainless steel
- 200°C maximum bakeout
- 304ss flange
- Custom lengths available on request
- Other configurations available on request

Nominal ID	Flange size	Flange OD	Nominal length	Wt kg	Reference	Part number
14	DN16KF	30	76	0.2	KDEG-075	462020
21	DN25KF	40	81	0.3	KDEG-100	462021
33	DN40KF	55	84	0.4	KDEG-150	462022
46	DN50KF	75	96	0.7	KDEG-200	462023

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Viewports

Coated UHV viewports for extreme performance

Anti-reflective coatings

Figure 1 Reflection and transmission for sapphire, uncoated

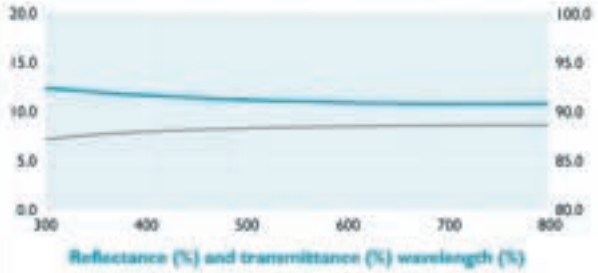


Figure 2 Single QWOT* layer of MgF_2 on sapphire

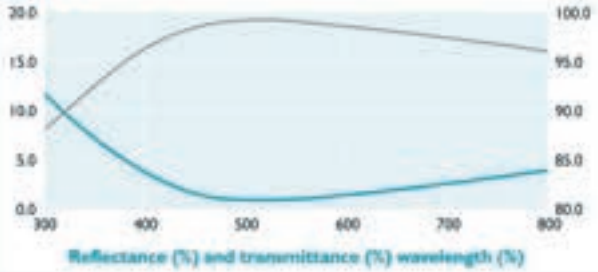


Figure 3 Single QWOT* layer of MgF_2 on optical glass

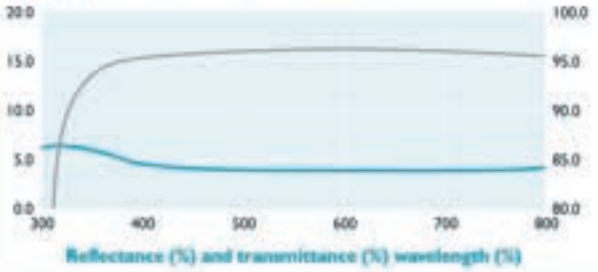
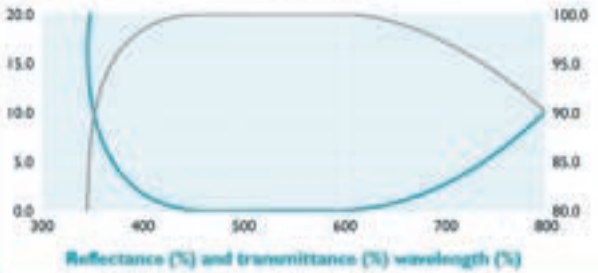


Figure 4 Broad band coating on sapphire



*QWOT = Quarter wave optical thickness

Introduction

All windows and viewports suffer reflectivity losses which can be up to 6% per surface for high refractive index materials such as sapphire (Figure 1).

This problem can be a severe limitation in many applications requiring optical fidelity, e.g. viewing of low luminosity against a high ambient; power transmission etc. The problem can often be mitigated by using anti-reflection coatings (Figure 2).

For more conventional viewport materials such as optical glass and fused quartz, this approach would also provide useful benefits (Figure 3).

Broad band coatings are optimized typically for the visible range and give the best general performance with a reflected luminosity of only 0.13% and transmitted luminosity of 99.86% as shown in Figure 4.

Coated UHV viewports for extreme performance

More complex multi-layer dielectric coatings enable a wide variety of tailored transmission/reflection characteristics.

For applications requiring the best transmission at a single wavelength, such as high power laser applications, Caburn can provide a 'V' coating which has almost zero reflection at a design wavelength (1064nm for example in Figure 5), or at two wavelengths ('W' coating). This also applies to wide band BBAR or neutral density attenuation, and many others (Figure 6).

Coating options
Standard or non-magnetic CF flange

Anti-reflection single QWOT
Coated on both sides Optimized for 550nm

Size	Reference	Part number
DN16	CVP-16AR	1210400
DN40	CVP-40AR	1210401
DN63	CVP-63AR	1210402
DN100	CVP-100AR	1210403
DN160	CVP-160AR	1210404

Anti-reflection multilayer V
Coated on both sides
Optimized for wavelength specified by customer

Size	Reference	Part number
DN16	CVP-16VAR	1210408
DN40	CVP-40VAR	1210409
DN63	CVP-63VAR	1210410
DN100	CVP-100VAR	1210411
DN160	CVP-160VAR	1210412

Anti-reflection multilayer
Broad band coated on both sides
Optimized for 400 to 600nm

Size	Reference	Part number
DN16	CVP-16BBAR	1210416
DN40	CVP-40BBAR	1210417
DN63	CVP-63BBAR	1210418
DN100	CVP-100BBAR	1210419
DN160	CVP-160BBAR	1210420

Figure 5 V coating on optical glass

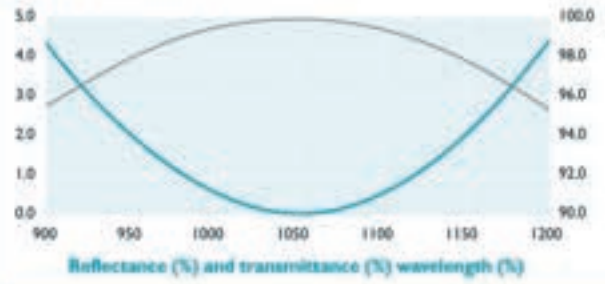
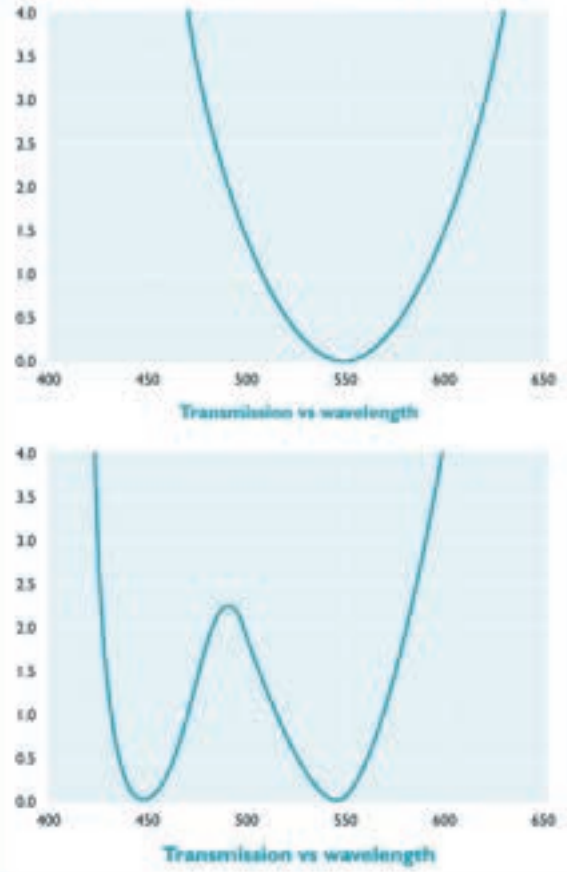


Figure 6 Reflection vs wavelength v and w coating



Other window material available

- Quartz SiO_2
- Sapphire Al_2O_3

*These coatings are also available on viewports in KF and ISO flanges

KF	DN40, DN50, DN100
LF	DN100, DN160, DN200

* Prices on application

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Viewports

Coated UHV viewports for extreme performance

Conductive coatings

Viewports with transparent conductive coatings such as ITO – **indium tin oxide** can provide surface conductivity either to eliminate the build up of electrostatic charge, or to improve EMC/RFI screening. For electrostatic problems a thin ITO coating giving ~1kΩ/sq and optimum optical transmission is usually employed (Figure 7).

For screening problems thicker more conductive coatings are used giving typically ~10Ω/sq (Figure9).

Figure 7 Visual transmittance of ITO conductive coating

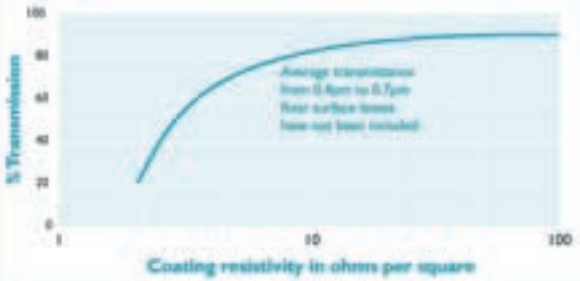
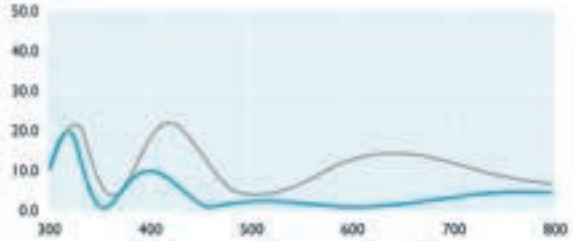
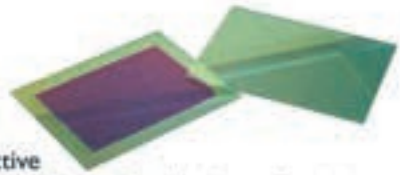


Figure 8



AR coating on conductive coated viewports

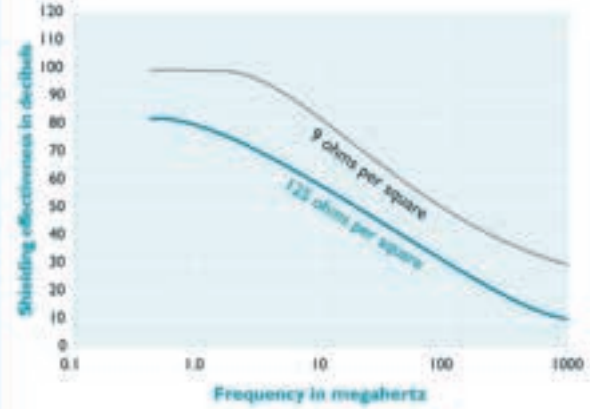


As ITO has a high refractive index, the coated window will also have higher reflectivity after coating with ITO. For this reason Caburn can also provide an AR overcoat which will reduce reflections.

The figure below shows the front surface reflection form ITO coated glass before and after the application of a simple AR overcoat.

Obviously this is not applicable where electrostatic screening against charge build up is required, but where EMC/RFI is the issue the improvement in optical performance is quite striking as illustrated in the photograph above. This shows a sheet of ITO coated glass viewed at an angle where the surface reflection is most visible, beside a similar sheet where the central section has been AR coated leaving a frame around the outside to make electrical connection.

Figure 9 Shielding effectiveness of conductive films



Coating options for standard or non-magnetic viewports CF flange

Anti-charging ITO coated on vacuum side <2k/sq

Size	Reference	Part number
DN16	CVP-16ITO	1210500
DN40	CVP-40ITO	1210501
DN63	CVP-63ITO	1210502
DN100	CVP-100ITO	1210503
DN160	CVP-16ITO	1210504

ITO coated on vacuum side <10Ω /sq

Size	Reference	Part number
DN16	CVP-16ITOEMC	1210516
DN40	CVP-40ITOEMC	1210517
DN63	CVP-63ITOEMC	1210518
DN100	CVP-100ITOEMC	1210519
DN160	CVP-160ITOEMC	1210520

Anti-charging ITO coated on vacuum side <2k/sq+AR coating

Size	Reference	Part number
DN16	CVP-16OAR	1210508
DN40	CVP-40OAR	1210509
DN63	CVP-63OAR	1210510
DN100	CVP-100OAR	1210511
DN160	CVP-160OAR	1210512

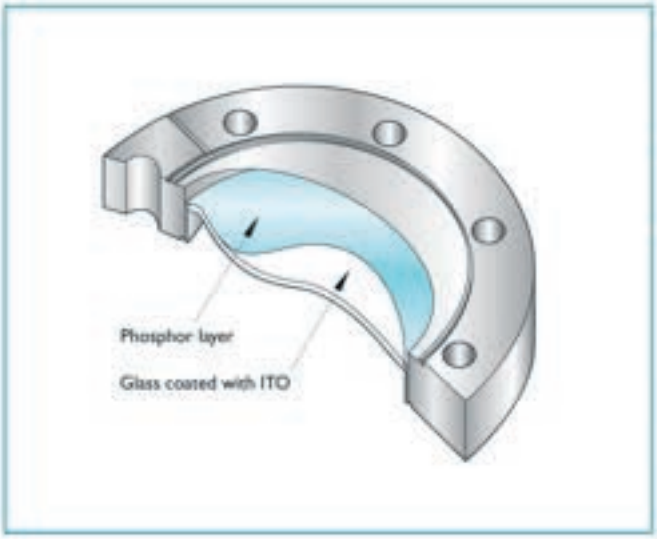
RFI/EMC ITO coated on vacuum side <10Ω /sq+AR coating

Size	Reference	Part number
DN16	CVP-16ITOEMCAR	1210524
DN40	CVP-40ITOEMCAR	1210525
DN63	CVP-63ITOEMCAR	1210526
DN100	CVP-100ITOEMCAR	1210527
DN160	CVP-160ITOEMCAR	12104528

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Viewports

High resolution phosphor viewport screens



Typical RHEED arrangement with the CF viewport being coated with ITO (indium tin oxide, a clear electrically conducting film) underneath a uniform layer of phosphor.

Description

High resolution screens for Rheed phosphor thickness - type is determined by application.

Typical phosphor types

(others available on request)

- P20
- P22
- P11
- P43

Understanding the user's applications means that we can determine the required thickness to optimise brightness, whilst maintaining a high degree of resolution for clear images.

For high voltage applications there may be a need for lead glass protection from potentially harmful X-rays.

An additional lead glass disc is fastened to the atmospheric side of the CF flange.

All types have been prepared for UHV systems by high temperature bake out prior to shipping.

Sizes available from DN40CF to DN160CF.

Rheed specifications

Size	Description	Reference	Part number
DN40CF	CVP-40 Viewport coated with P22 phosphor over a layer of ITO	CVP-40RHEED	1210600
DN63CF	CVP-63 Viewport coated with P22 phosphor over a layer of ITO	CVP-63RHEED	1210601
DN100CF	CVP-100 Viewport coated with P22 phosphor over a layer of ITO	CVP-100RHEED	1210602
DN160CF	CVP-160 Viewport coated with P22 phosphor over a layer of ITO	CVP-160RHEED	1210603

Size	Description	Reference	Part number
DN100CF	CVP-100 – with external lead glass disc	CVP-100RHEEDLG	1210607
DN160CF	CVP-160 – with external lead glass disc	CVP-160RHEEDLG	1210608

All dimensions are nominal in millimetres unless specified - Weights given are approximate