Our window choices:

http://www.rayotek.com/techincal_info_glass_sapphire.htm

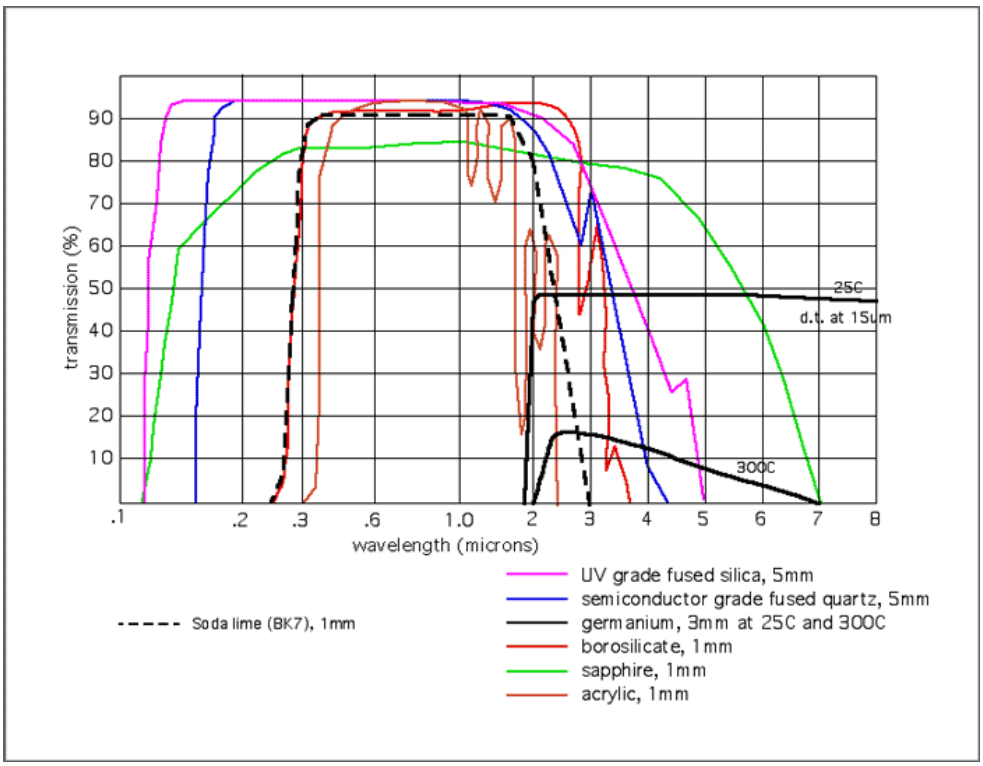
Corning 7056 Borosilicate Glass: mostly SiO2 doped with boron, amorphous, cheapest, more impurities compared to fused silica, or fused quartz, 90% transmission from 300 to 2000nm

Fused Quartz: mostly SiO2, but with less impurity than 7056 glass, more impurity than fused silica, also referred to as "glass", amorphous, slightly enhanced transmission compared to borosilicate 7056 glass, 90% transmission from 200 to 2500nm

Fused Silica: mostly SiO2, the "purest" glass, also referred to as "glass", amorphous, enhanced transmission in UV

Pyrex: trademark name, a form of borosilicate glass, SiO2 doped with mystery chemical, easy to hot work compared to conventional borosilicate glass, glass blowers like it

Sapphire: aka aluminum oxide Al2O3, crystalline, very birefringent, the widest transmission range of typical window material 200 to 6000 nm, a very hard material with hardness close to that of diamond, scratch resistant, excellent thermal conductivity



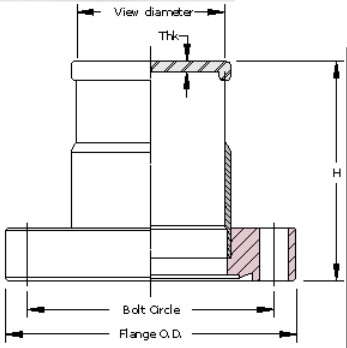
Practical concerns when choosing a window:

How is the window material attached to the flange? This sets the safe bakeout temp and to influences degree of birefringence. Do you want it AR coated? Housekeeper seal, zero-profile or zero-length, mushroom top (which doesn't seem to be available anymore but there are probably still some examples in our cabinets, I suspect they are fused quartz or silica windows, because they vented at 201 C)

We use the one shown below alot. Housekeeper seal, borosilcate 7056 glass. Nonmagnetic steel, and with window sealing technique that makes it very rugged for bakeouts. Relatively inexpensive. Compared to other window sealing techniques (i.e., brazing), John and I found the housekeeper seal to be pretty good re: small birefringence. We used to test them individually, and pick the window with smallest birefringence. Tough to AR coat both sides.

Viewports
Viewports - Zero Profile 7056 Glass

Introduction | UHV Series | HV Series | Nonmagnetic - UHV Series



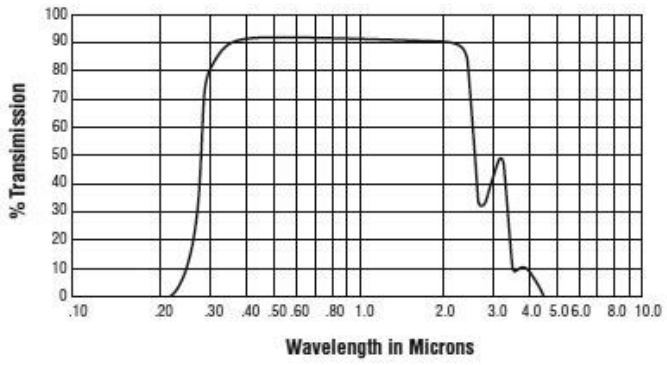
Features

- Nonmagnetic construction
- Del-Seal™ CF flange
- Stainless steel sleeve

Construction Note
Non-magnetic construction requires longer transition length between seal joints and weld joints. The stainless steel sleeve is thinned out to give maximum flexibility at the glass to metal seal.

Specifications	
Viewport Type	Glass
Properties	
Zero Length	No
Magnetic	No
Bakeout Max	400°C
Maximum Thermal Gradient	10°C/MIN
Materials	
Window	Borosilicate
Sleeve	304ss
Braze	Fused
Comments	Housekeeper seal

For conversion tables click here

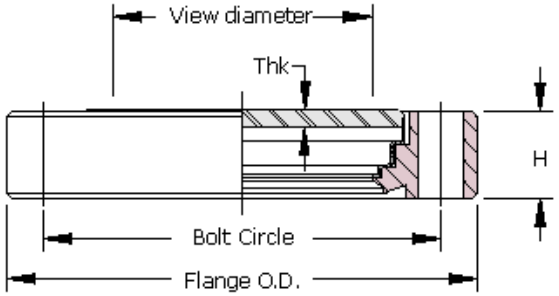


Transmission curve for cheap borosilicate 7056 glass, fine for making beam from GaAs photocathodes: polarized beam at 780nm and also good for making beam with 532nm light.

Another good choice for us: cheap borosilicate 7056 glass on zero-profile flange. Easy to AR coat both sides. But it's attached to magnetic steel, probably not a good choice for applications that involve delivering beam somewhere.

Viewports
Viewports - Zero Profile 7056 Glass

Introduction | UHV Series | HV Series | Nonmagnetic - UHV Series



Features

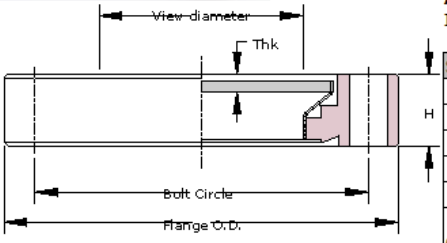
- 7056 Glass
- Zero Profile
- Del-Seal™ CF flange
- Kovar sleeve

Specifications	
Viewport Type	Glass
Properties	
Zero Length	Yes
Magnetic	Yes
Bakeout Max	400°C
Maximum Thermal Gradient	10°C/MIN
Materials	
Window	Borosilicate
Sleeve	NiFe
Braze	Fused
Comments	Matched expansion seal
For conversion tables click here	

Fused silica: let's not use this window….it will leak during a 250 C bakeout. Not worth the trouble for slightly enhanced transmission range.

Viewports
Viewports - Zero Profile Quartz

Introduction | UHV Series | HV Series

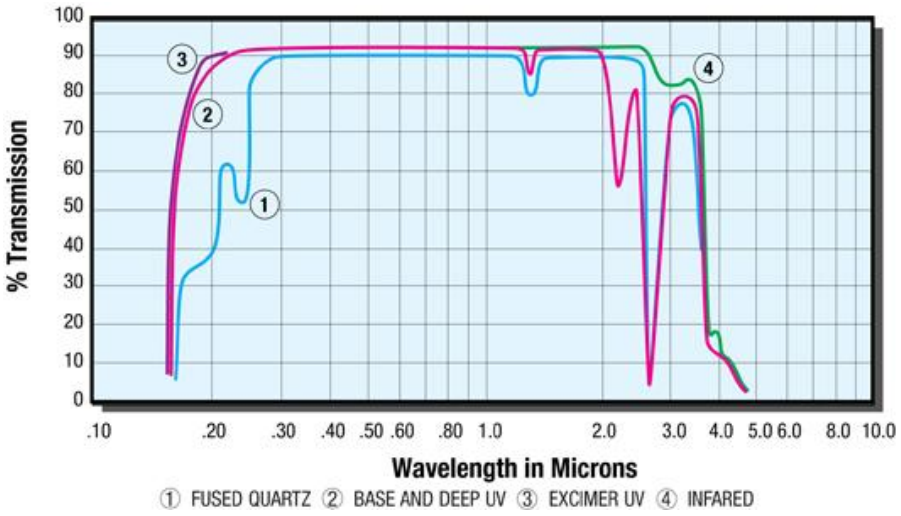


Features

- UV grade Fused Silica
- Zero profile
- Del-Seal™ CF flange
- Stainless steel sleeve

Additional or similar configurations are available on Insulator Seal website. Go to Insulator Seal website

Specifications	
Viewport Type	Quartz
Properties	
Zero Length	Yes
Magnetic	No
Bakeout Max	200°C
Maximum Thermal Gradient	25°C/MIN
Materials	
Window	SiO2
Sleeve	304ss
Braze	PbAg
Comments	Braze Alloy Melts at 305°C
For conversion tables click here	



Sapphire window: excellent choice for applications that need UV light or far IR light. But we typically don't use UV or far IR light. A tough window, can be baked very hot, but suffers lots of birefringence.

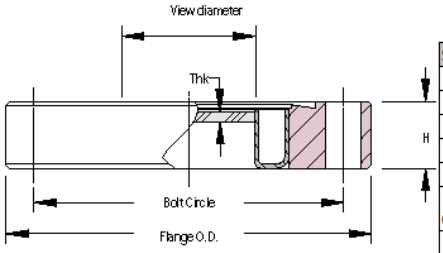
Viewports
Viewports - Zero Profile Sapphire

Introduction | UHV Series | HV Series

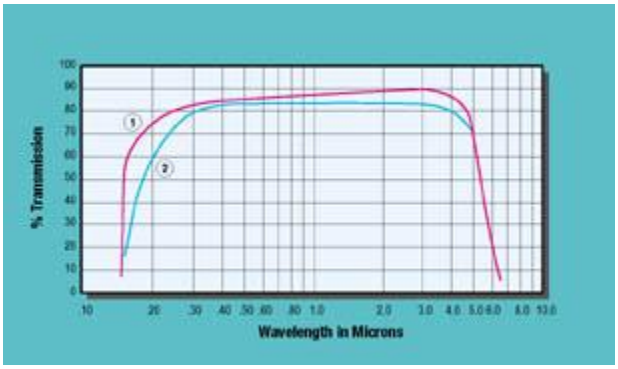
Features

- Regular grade and UV grade sapphire material *
- Zero profile
- Del-Seal™ CF flange
- Kovar sleeve

* UV grade sapphire, all other sizes are regular grade sapphire



Specifications	
Viewport Type	Sapphire
Properties	
Zero Length	Yes
Magnetic	Yes
Bakeout Max	450°C
Maximum Thermal Gradient	25°C/MIN
Materials	
Window	Al2O3
Sleeve	NiFe
Braze	AgCu
Comments	Braze Alloy Melts at 800°C
For conversion tables click here	

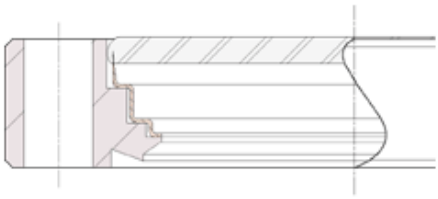


Transmission curve for sapphire. Extends to 5 um.

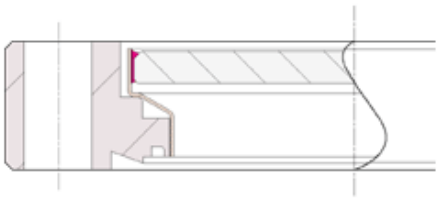
Viewports

Viewport Sealing Methods and Specifications

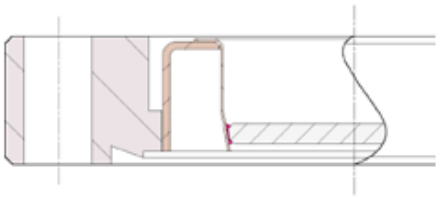
Glass
Glass is fused to a thin nickel-iron metal transition.



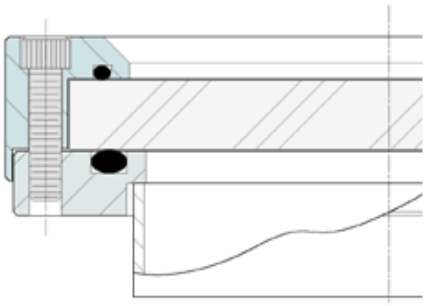
Quartz
Quartz is metalized and brazed directly to stainless steel using a lead-silver braze alloy.



Sapphire
Sapphire is metalized and vacuum brazed to a nickel-iron sleeve using a tapered seal interface.



Pyrex®
A Pyrex® substrate is sandwiched between two elastomer seals. The outer elastomer (top in drawing) is for cushioning and the inner elastomer (bottom in drawing) makes the vacuum seal.



Specifications									
Viewport Type	Properties		Bakeout Max		Maximum Thermal Gradient	Materials			Comments
	Zero Length	Magnetic	(CF)	(ISO)		Window	Sleeve	Braze	
Glass	Yes	Yes	400°C	200°C	10°C/min	Borosilicate	NiFe	Fused	Matched expansion seal
Glass	No	No	400°C	200°C	10°C/min	Borosilicate	304ss	Fused	Housekeeper Seal
Quartz	Yes	No	200°C	200°C	25°C/min	SiO2	304ss	PbAg	Braze alloy melts at 305°C
Sapphire	Yes	Yes	450°C	200°C	25°C/min	Al2O3	NiFe	AgCu	Braze alloy melts at 800°C

What is the message? Because we frequently bake at 250C, we have two options: Borosilicate Glass and Sapphire. Of these I prefer Glass because sapphire is so damn birefringent. Glass windows have reasonably good tranmission, from 300nm to 1000nm, so fine for both types of photocathodes we study: GaAs and CsK2Sb.

So for borosilicate 7056 glass windows, we can choose between two styles, “zero length (or zero-profile)” and “housekeeper”. For beamline applications, with beam at high voltage, and for miniMotts, where we try to deliver beam some distance, I think the choice is housekeeper seal, because it’s non-magnetic. For QE studies, either window is fine. It will be easier to AR coat a zero profile window.

We don’t use quartz windows, either fused silica or fused quartz. They vent during bakeouts, something we learned the hard way.