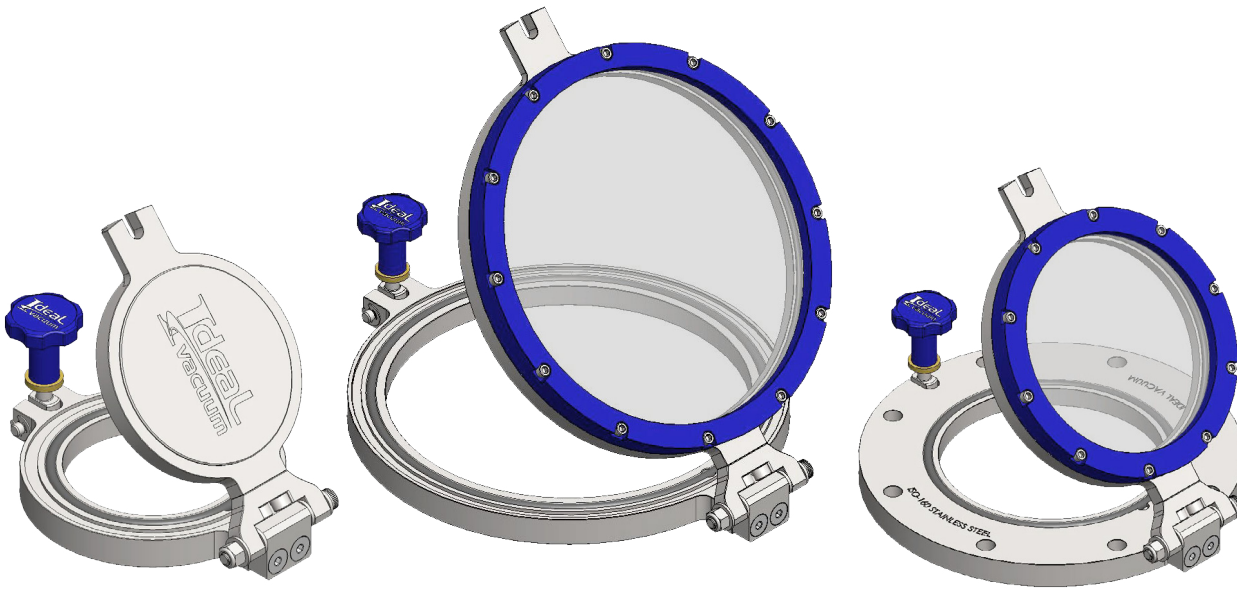
OUR PRODUCTS DEVELOP TOMORROW'S TECHNOLOGIES™

FAST ACCESS ISO DOORS (FAD)

USER MANUAL



With ISO-K & ISO-F 100, 160, 200, & 250 Flanges

FAD-06022025 - V 1.0.3

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SAFETY

IMPORTANT SAFETY INFORMATION

Thank you for purchasing this equipment from Ideal Vacuum Products. We want you to operate it safely.

- **Read this manual before installing or operating this equipment. Failure to follow the warnings and instructions may result in serious injury or equipment damage.**
- **Keep this manual in a safe location for future reference.**
- **This equipment should only be installed and operated by trained, qualified personnel, wearing appropriate protective equipment.**
- **Follow all codes that regulate the installation and operation of this equipment.**

WARNING SYMBOLS AND DEFINITIONS



This is the universal safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER	**Indicates an imminently hazardous situation that, if not avoided, will result in death or severe injury.**
WARNING	**Indicates an imminently hazardous situation that, if not avoided, could result in death or severe injury.**
CAUTION	**Indicates a potentially hazardous situation that, if not avoided, could result in moderate or minor injury. It may also be used to alert against unsafe practices.**
NOTICE	**Indicates a potentially hazardous situation that, if not avoided, could result in equipment or property damage.**
NOTE	**Indicates helpful tips and recommendations, as well as information for efficient, trouble-free operation.**

Internationally recognized safety symbols may be used with safety warnings to specify the type of hazard or a safety protocol to follow. For example:



Indicates an electric shock hazard



Indicates safety glasses are required

ADDITIONAL SAFETY FOR VIEWING WINDOWS

DANGER





Implosion/explosion hazard. Failure to follow ALL instructions and safety precautions can result in serious injury or death.

CAUTION





Always wear protective equipment, including safety glasses and gloves. Exercise care when working with any vacuum component.

All viewing windows or ports are inherently fragile. Exercise great care when handling, mounting and when using a chamber with a viewing window. Below are specific warnings and special precautions needed for safely installing and using a viewing window.

VISUAL INSPECTION

Visually inspect the window upon receipt and check regularly for scratches or any irregularity. Even small scratches can cause a weak spot in the window causing failure. Keep hard objects away from the window. Use only a soft cloth or lens tissue and isopropyl alcohol (IPA) for cleaning.

MOUNTING AND ASSEMBLY

Carefully follow all mounting and reassembly instructions in this manual if you are replacing or servicing the window pane. Strictly adhere to the bolt torque specifications and tightening order pattern. Over-tightening of bolts DOES NOT produce a more leak-proof seal. Overtightening, or failure to properly reassemble a viewing window assembly could cause internal strain buildup in the window material resulting in failure.

PRESSURE

NEVER subject a viewing window equipped chamber to positive internal pressure. The viewing window is designed and rated for VACUUM ONLY. Chamber pressures in excess of ambient atmosphere could cause the viewing window assembly to fail catastrophically.

TEMPERATURE CHANGES AND THERMAL SHOCK

The fragile nature of the window makes it susceptible to thermal shock. Rapid temperature changes under vacuum, hot or cold, can cause failure. Bakeout or cooling is permissible within the temperature rating of the Viton® O-ring seals. Keep chamber temperature change rates to <10° C/min (<18° F/min).

If directing a laser beam through the window, make sure the laser's wavelength can be reasonably transmitted through the window's material. Directing a laser through the window of a wavelength the window material absorbs, or focusing a laser of any wavelength within the window medium, will cause a steep thermal gradient extending outward from the point of incidence. This could result in localized weakening or fracturing of the window.

1. GENERAL INFORMATION

1.1 INTRODUCTION

Ideal Vacuum Fast Access ISO Doors (FADs) are a popular accessory for vacuum chamber systems with ISO ports. They are used in place of blank ISO-K or ISO-F flanges and allow a user to inspect chamber processes, perform optical experiments, and quickly access the chamber for exchanging test objects. A FAD can be added to a vacuum chamber ISO port at any time.

FADs are available in ISO 100, 160, 200 and 250 flange sizes with choice of ISO-K or ISO-F flanges. The FAD may include a viewing window, or be a blind door.

Claw clamps, or metric nuts, bolts, and washers, along with ISO centering rings are used to mount FADs to ISO ports. The specific hardware needed for mounting depends on the ISO flange size and flange connection configuration.

For information about selecting the correct hardware for your application and how to properly mount ISO fittings for leak-proof seals, please download:

idealvac.com/files/manuals/Common_Vacuum_Fittings-Selection_and_Assembly_Guide.pdf.

Two materials are available for windowed FADs: tempered glass and fused silica. Complete FAD assemblies and replacement/upgrade window pane options are listed in Sec. 1.3, p. 8.

FADs with windows employ a zero metal-to-glass contact design that holds a 3/8” thick window pane to a stainless steel ISO mounting plate. Windows are cushioned by Viton® O-rings on both window faces and use PTFE dowel pin spacers around the window edges. This cushioned window mounting system ensures operator safety and window longevity. The simple construction makes the FAD field serviceable. Bakeout to 150°C is permissible.

All parts that make up the FAD are carefully selected for vacuum system compatibility and durability. All production, assembly and testing is done in our own manufacturing facility in Albuquerque, NM, U.S.A. Before it ships, every Fast Access ISO Door is fully assembled, visually inspected for window imperfections, helium leak tested, cleaned, and sealed. This ensures that it operates correctly, safely, and is ready for immediate installation upon delivery.

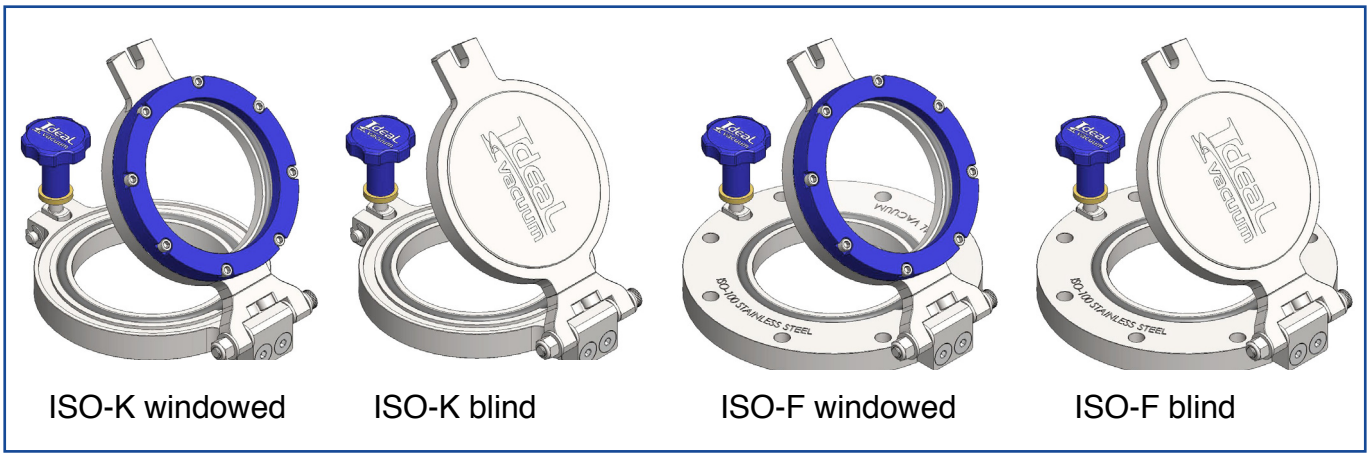


Figure 1 - ISO-K and ISO-F windowed or blind Fast Access Doors

1.2 SPECIFICATIONS

Parameter	Measure/Type	
Ultimate vacuum pressure	3 x 10^{-8} Torr	
Leak rate	<1 x 10^{-8} std cc/sec atm Helium	
Temperature rating	-20° to 150° C (-4° to 302° F)	
Max. temperature change rate	10° C/min (18° F/min) max	
Part	**Materials**	
Viewing window	3/8" thick; tempered glass or fused silica	
Window trim ring	6061-T6 blue anodized aluminum	
ISO-K and ISO-F flange	304L stainless steel	
O-ring seals	Viton®	
Dowel pin spacers	PTFE, 3/16” x 3/8” Long	
Trim ring hold-down screws	18-8 stainless steel, 8-32 x 5/8” long	
Window Size	**Viewing Diameter**	**Viewable Area**
ISO 100	3.5 in.	9.1 $in.^2$
ISO 160	5.2 in.	21.2 $in.^2$
ISO 200	7.8 in.	47.8 $in.^2$
ISO 250	9.6 in.	72.4 $in.^2$

Table 1 - Technical specifications

1.3 COMPLETE FAED ASSEMBLIES

Fast Access Doors - Complete Assemblies						
ISO Size	**ISO-K Tempered Glass**	**ISO-K Fused Silica**	**ISO-K Blind Door**	**ISO-F Tempered Glass**	**ISO-F Fused Silica**	**ISO-F Blind Door**
100	P1013787	P1013804	P1013812	P1013786	P1013803	P1013811
160	P1013789	P1013806	P1013814	P1013788	P1013805	P1013813
200	P1013791	P1013808	P1013816	P1013790	P1013807	P1013815
250	P1013793	P1013808	P1013818	P1013792	P1013809	P1013817

Table 2 - Part number selector for complete assemblies

1.4 REPLACEMENT/REBUILD PARTS

Replacement Media and Parts					
ISO Size	Replacement Tempered Glass Media	Replacement Fused Silica Media	Window Seal Kit with 3 Viton O-rings & 4 PTFE spacers	Blind Door Replacement O-ring Seal	Mounting Centering Ring (304 SS w/Viton O-ring)
100	P1011885	P1012375	P1013875	P1013879	P101763
160	P1011886	P1012376	P1013876	P1013880	P101764
200	P1011887	P1012377	P1013877	P1013881	P101765
250	P1011888	P1012378	P1013878	P1013882	P105424

Table 3 - Part number selector for replacement and repair parts

1.5 ISO-K FLANGE CONNECTIONS WITH CLAW CLAMPS

Use double claw clamps to join ISO-K FADs to ISO-K flanges. Use single claw clamps to join ISO-K FADs to ISO-F flanges with tapped holes.

Flange Size	Min. # Clamps	Optimal # Clamps	Double Claw	Single Claw
ISO-K 100	4	8	P104066	P108058
ISO-K 160	4	8	P104067	P104065
ISO-K 200	6	12	P104067	P104065
ISO-K 250	8	12	P104067	P104065

Table 4 - Part number selector: ISO-K claw clamps

1.6 ISO-F CONNECTIONS WITH NUTS, BOLTS, AND WASHERS

Use metric nuts, bolts, and washers to join ISO-F FADs to ISO-F flanges. ISO-F FADs have smooth bored flange holes. Different bolt kits are needed depending on the flange to which it is bolted.

Flange Size	Thread Size	# Holes	Bolt Kit for One Smooth Bored & One Tapped Flange	Bolt Kit for Two Smooth Bored Flanges	Single Bolts for Tapped Bulkhead Flanges
ISO-F 100	M8 X 1.25	8	P101780	P101776	P1013039
ISO-F 160	M10 x 1.50	8	P101781	P101777	P1013040
ISO-F 200	M10 x 1.50	12	P101782	P101778	P1013040
ISO-F 250	M10 x 1.50	12	P101782	P101778	P1013040

Table 5 - Part number selector: ISO-F nuts, bolts, and washers

1.7 EXPLODED VIEWS

1.7.1 ISO-K WINDOWED FAD

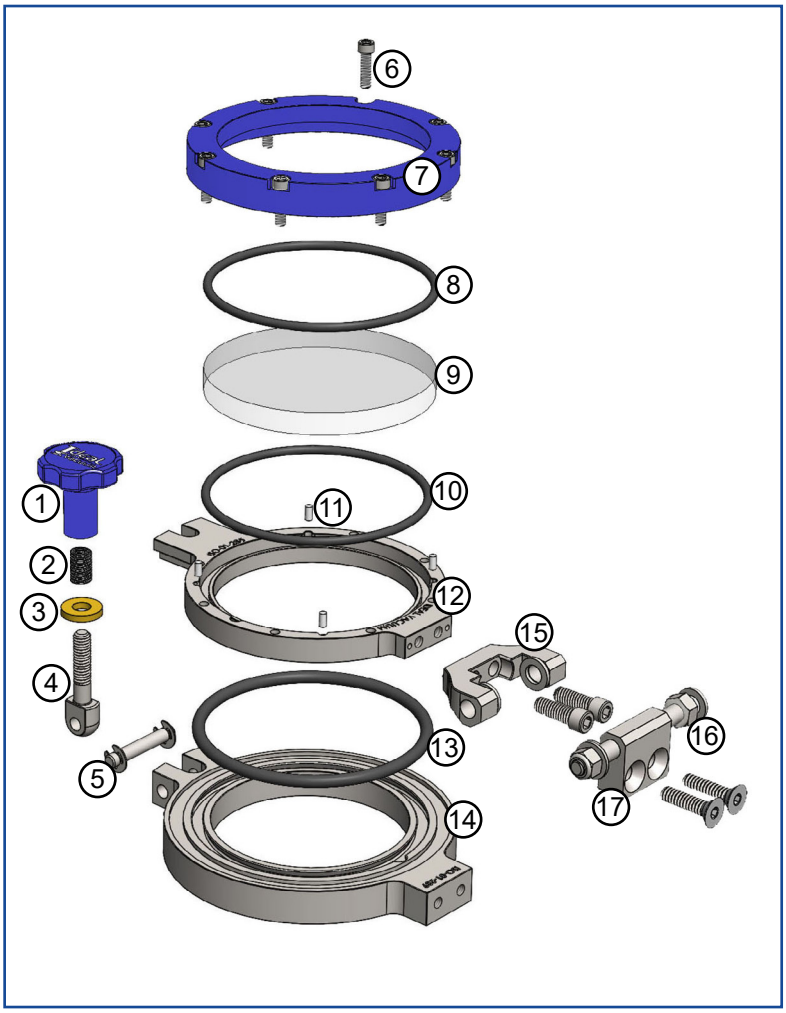


Figure 2 - Exploded View - ISO-K windowed FAD

Item	Description
1	Closure knob (blue anodized aluminum)
2	Heli-coil insert
3	Thick brass washer
4	Flat shoulder rod end bolt
5	Headless clevis pin w/retaining grooves and clips
6	Window trim ring hold down screws (8-32 x 5/16”, 18-8 SS)
7	Window trim ring (blue anodized aluminum)
8	Window trim ring thin O-ring (Viton)
9	Window pane (tempered glass or fused silica)
10	Window mounting plate thin O-ring (Viton)
11	PTFE dowel pins (x4)
12	Window mounting plate
13	ISO flange thick O-ring (Viton)
14	ISO-K mounting flange
15	Bolt-on hinge fork
16	Hinge hex bolt, 5/16-24 x 2-3/4”
17	Bolt-on hinge block

Table 6 - ISO-K FAD components

1.7.2 ISO-F WINDOWED FAD

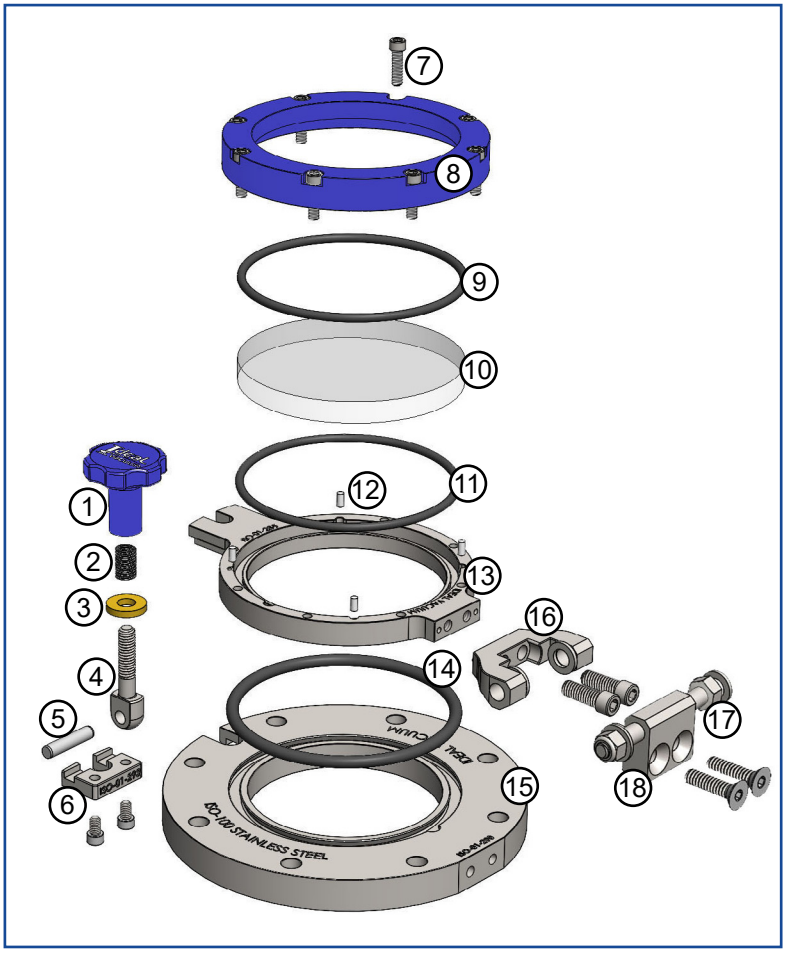


Figure 3 - Exploded View - ISO-F windowed FAD

Item	Description
1	Closure knob (blue anodized aluminum)
2	Heli-coil insert
3	Thick brass washer
4	Flat shoulder rod end bolt
5	Dowel pin (1/4” x 1-1/8”)
6	Bolt-on pillow block
7	Window trim ring hold down screws (8-32 x 5/16”, 18-8 SS)
8	Window trim ring (blue anodized aluminum)
9	Window trim ring thin O-ring (Viton)
10	Window pane (tempered glass or fused silica)
11	Window mounting plate thin O-ring (Viton)
12	PTFE dowel pins (x4)
13	Window mounting plate
14	ISO flange thick O-ring (Viton)
15	ISO-F mounting flange
16	Bolt-on hinge fork
17	Hinge hex bolt, 5/16-24 x 2-3/4”
18	Bolt-on hinge block

Table 7 - ISO-F FAD components

1.7.3 ISO BLIND DOOR FADS

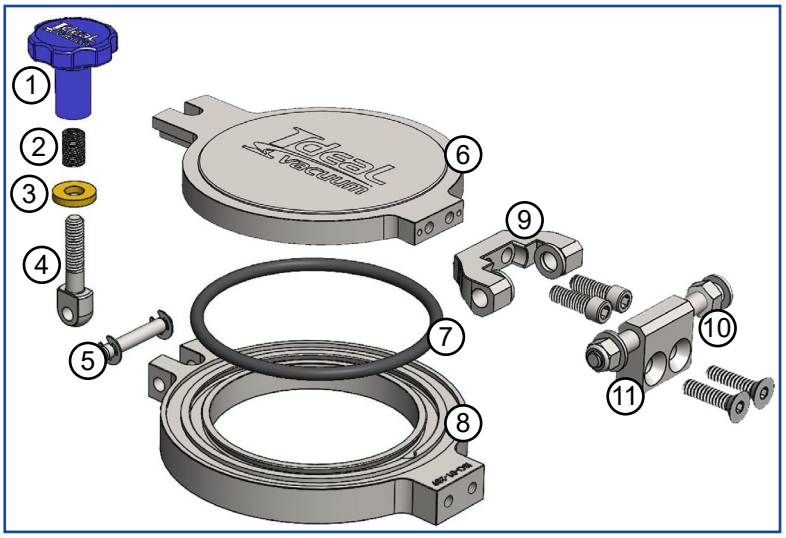


Figure 4 - Exploded View - ISO-K blind door FAD

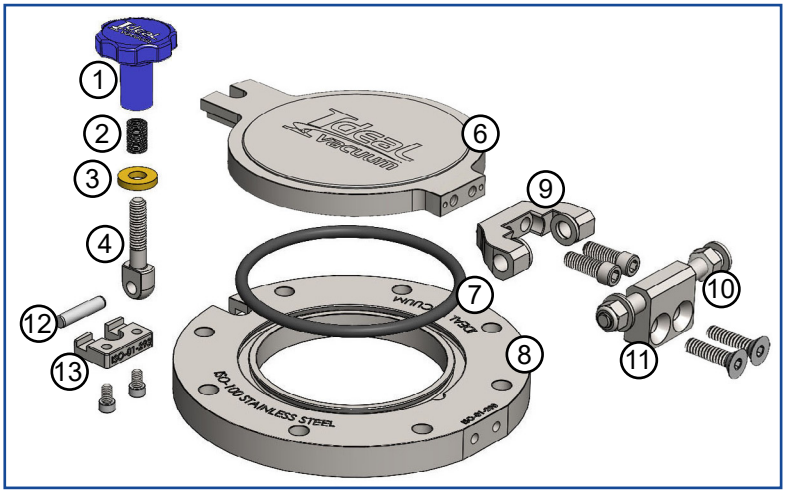


Figure 5 - Exploded View - ISO-F blind door FAD

Item	Description
1	Closure knob (blue anodized aluminum)
2	Heli-coil insert
3	Thick brass washer
4	Flat shoulder rod end bolt
5	Headless clevis pin w/retaining grooves and clips
6	Blind door
7	ISO flange thick O-ring (Viton)
8	ISO-K mounting flange
9	Bolt-on hinge fork
10	Hinge hex bolt, 5/16-24 x 2-3/4”
11	Bolt-on hinge block
12	Dowel pin (1/4” x 1-1/8”)
13	Bolt-on pillow block

Table 8 - ISO blind door FAD components

1.8 WINDOW MATERIAL CHARACTERISTICS

The selection of a suitable window material depends largely on its intended purpose. Two window materials for Fast Access Doors are available: standard low-iron tempered float glass and high purity fused silica (comparable to Corning HPFS 7980). Both types are polished plate material.

The high clarity, tempered window glass option is standard low-iron float glass. It has a surface quality and flatness of Q4 per ASTM 1036-06 and 1048-04. This glass exhibits a slight blueish tint. It is the more economical window material and is most commonly used for general, direct observation of roughing or high-vacuum chamber processes and can be used to facilitate optical alignments of chamber components, observe degassing of fluids, or used to help teach vacuum processes by direct observation. This glass is not suitable for high power laser experiments.

The high purity fused silica window option is ground and polished to optical grade on both sides with a total thickness variation (TTV) of <10μm, a surface finish of S/D 40/20, and a surface roughness of Ra < 1 nm. These windows have appreciably improved transmittance, and a wider useful wavelength range than standard glass. Characteristics include extraordinarily low refractive index variations, low birefringence values, and an ultra-low thermal expansion coefficient. Fused silica is used for transmissive optics where a high laser damage threshold is required. Fused silica is used for optics operating in the deep UV, visible, and the near infrared wavelength range.

The figure below shows a comparison of the percent transmission of light including both reflection and absorbtion effects over the range of wavelengths that the two available viewing window pane materials can pass without unreasonable energy absorption. The graph shows that both materials have excellent transmissivity throughout the visible range. Below approximately 350 nm, standard glass begins to absorb energy significantly. Fused silica does not become overly absorptive until well into the deep UV (<200 nm) and maintains excellent transmissivity into the Mid IR (≈ 2100 nm). It does exhibit a broad OH absorption band between 2600 and 2800 nm.

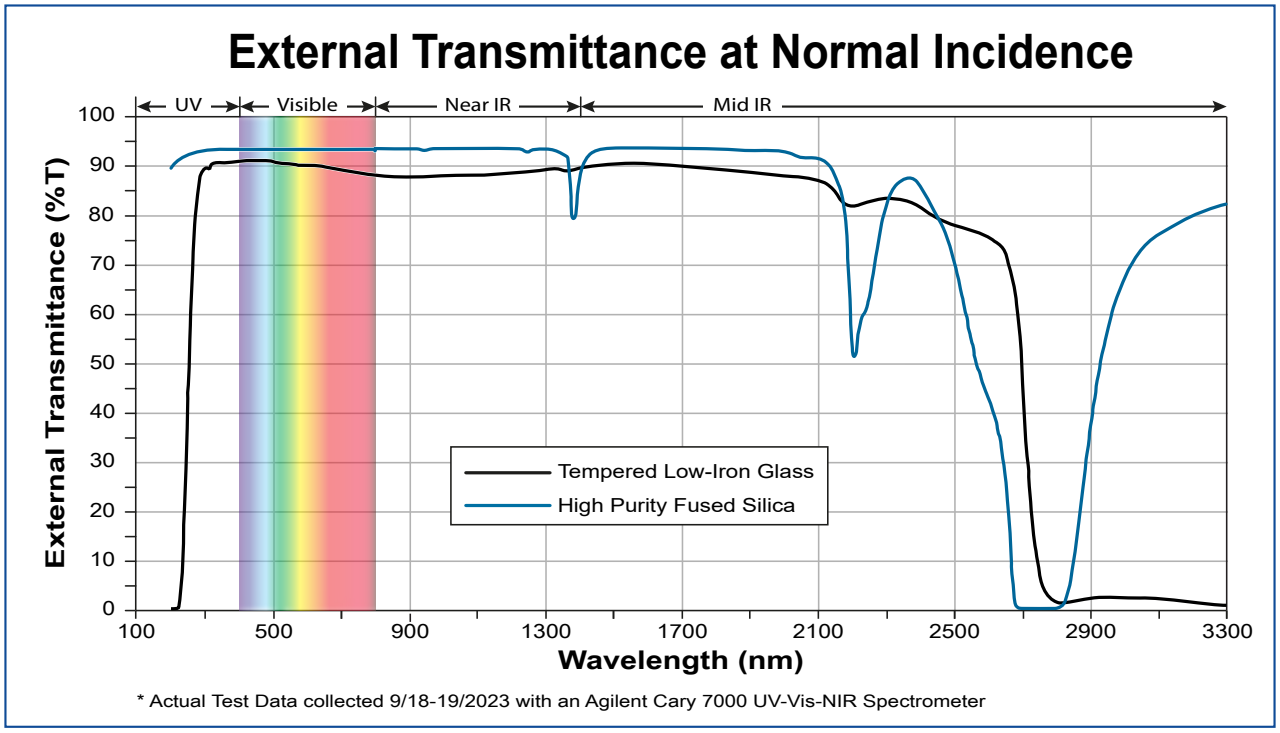


Figure 6 - External transmittance of tempered glass and fused silica at normal incidence

2. DOOR OPERATION

NOTICE

The chamber must be brought to ambient atmospheric pressure before the Fast Access Door can be opened.

To open the door, simply unscrew the knob until it is loose enough that it swings off the window flange fork.

Pull the window mounting plate or blind door open. The finger recess under the fork makes it easier to pull open.

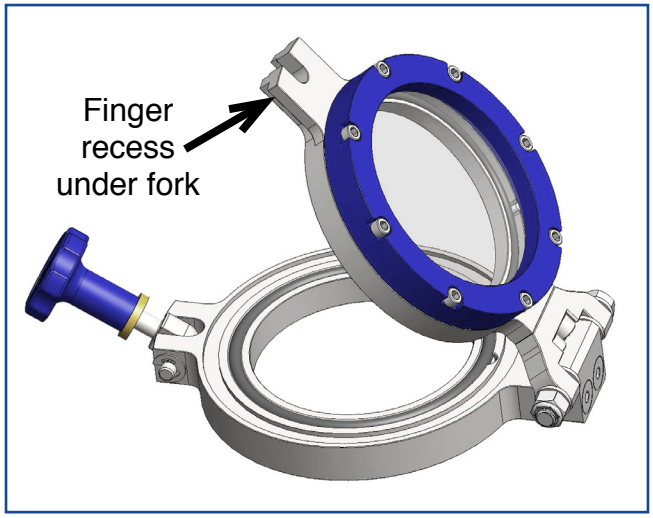


Figure 7 - FAD opened

Close the door by pushing on the window mounting plate or blind door. Do not touch the window with bare hands.

Rotate the door knob and brass washer over the window mounting plate fork.

Tighten the knob until the O-ring is slightly compressed.

Avoid over-tightening the door knob. It needs to only be hand-tight. The door will seal even if the O-ring is not fully compressed.

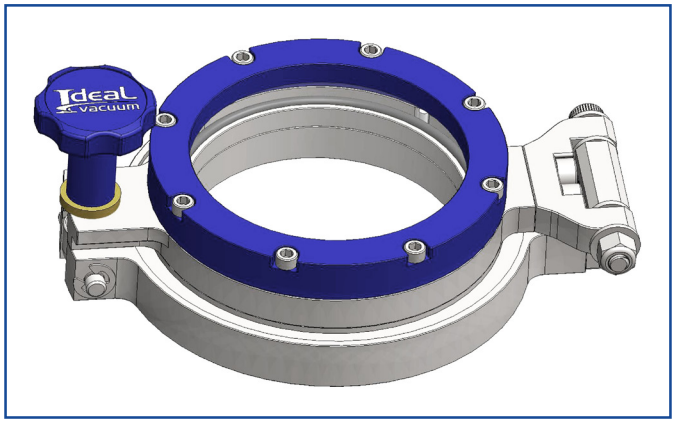


Figure 8 - FAD closed

3. WINDOW PANE SERVICE AND REPLACEMENT

⚠ WARNING



Fast Access Entry Doors and window pane materials are engineered with critical tolerances. Use only factory certified windows.

Inspect the FAD regularly as part of scheduled, system preventive maintenance. Occasional cleaning and servicing of the FAD is beneficial to maintain good operation. Particulates and other contaminants may begin to accumulate on the window pane, causing reduced transparency. The window could get scratched, chipped or otherwise damaged. O-ring seals harden over time, particularly if subjected to heating.

Disassembly may be required for any of these reasons:

1. If the window pane becomes dmaaged or can not be successfully cleaned.
2. If a window replacement or upgrade is needed or desired.
3. If the FAD develops a leak.

The design of the FAD allows the window pane and sealing O-rings to be replaced whenever necessary. Sec. 1.4, Table 3, p. 9 shows the available viewing window assemblies, replacement window panes and seal repair kits.

FAD Windows are demountable, meaning that the window pane can be removed while the rest of the assembly remains mounted to the chamber or the flange to which it is joined.

However, it is recommended to remove the entire FAD assembly from the vacuum chamber prior to maintenance or service. Depending on the ISO flange size and type, a 1/2”, 13 mm, or 17 mm wrench is required to install or remove claw clamps or ISO flange bolts.

All FADs are constructed similarly. However, each windowed FAD requires a different number of window trim ring 8-32 x 5/8” long socket head cap screws.

ISO Size	Number of 8-32 x 5/8” Long Trim Ring Screws
100	8
160	10
200	12
250	16

Table 9 - Window trim ring screws

3.1 DISASSEMBLY AND MAINTENANCE

⚠WARNING **Before performing any maintenance or service on the FAD the vacuum chamber must be at ambient atmosphere.**

NOTICE **Prepare and use a clean, soft surface to perform maintenance or service on a FAD. FADs with viewing windows are more fragile than many vacuum components. Be careful, use gloves, clean tools, and only recommended cleaning agents.**

The FAD may be cleaned using isopropyl alcohol (IPA) and a soft, clean lint-free cloth. It is best to demount and partially diassemble the FAD before performing any other service or maintenance. Refer to the exploded views (Sec. 1.7.1, p. 10).

If replacing an ISO flange O-ring on a blind door, skip to Sec. 3.2, Step 10, p. 21.

1. Use two 1/2” wrenches to remove the nylon locking nut from the hinge hex bolt. Remove the bolt. Save it and the four flat washers. They will be reused.



Figure 9 - Remove hinge hex bolt

2. Gradually unscrew the trim ring hold-down screws using a 9/64” hex wrench.



Figure 10 - Remove window trim ring screws

3. Remove all the trim ring screws and lift the window trim ring off the window.

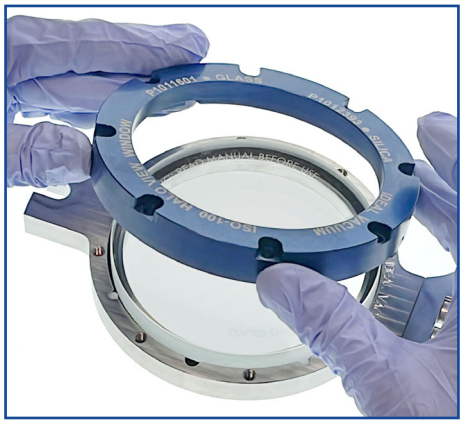


Figure 11 - Lift off trim ring

4. Carefully lift off the window pane and put it aside.

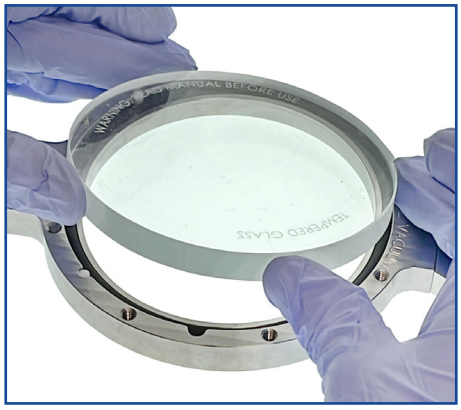


Figure 12 - Remove window pane

5. Remove the O-ring from the window mounting plate. The window mounting plates (both ISO-K and ISO-F) have specially machined recesses for easy O-ring removal. Use a plastic O-ring removal tool. Do not use a metal tool which could damage the O-ring or the O-ring groove.



Figure 13 - Remove the window mounting plate O-ring



Figure 14 - O-ring removal tool

6. Inspect the four PTFE dowel pins in the window mounting plate. They may be reused if undamaged. Otherwise remove them.

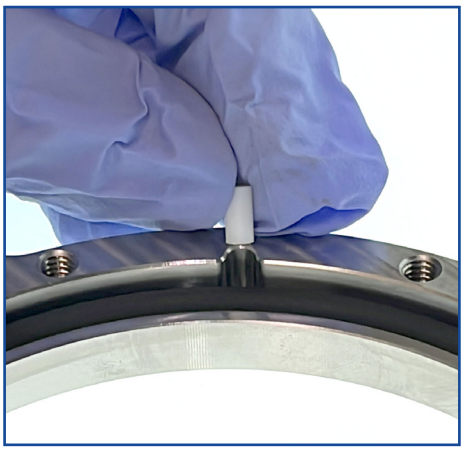


Figure 15 - Remove the four PTFE dowel pins

7. Get the blue window trim ring. Turn it over. Remove its O-ring.



Figure 16- Remove window trim ring O-ring

8. Get the FAD ISO mounting flange (ISO-K or ISO-F).

   Remove its O-ring using the same technique.

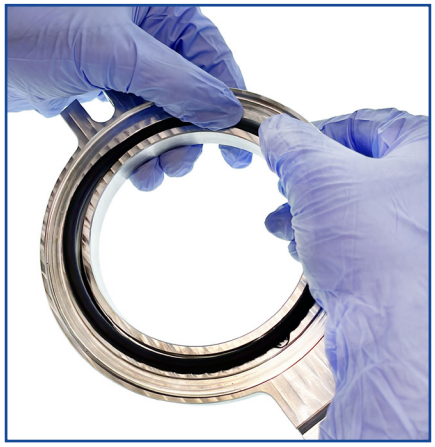


Figure 17 - Remove ISO mounting flange O-ring

9. Inspect the three FAD O-rings and ISO centering ring for damage. They can be reused as long as they remain pliable and are not permanently deformed. See Sec. 1.4, p. 9 for replacement parts.

10. Use a soft, clean, lint-free cloth and isopropyl alcohol (IPA) to clean the trim ring, mounting plate, ISO flange, O-rings, and O-ring grooves.

    Use only IPA and lens tissue to clean the window pane.

3.2 REASSEMBLY

Reassemble the FAD in reverse order of disassembly.

Do not use vacuum grease on the O-rings.

1. Insert the thick O-ring into the groove of the ISO mounting flange.

   If working on a blind door FAD, reassembly is complete. Mount and test for leaks.

If you are working on a windowed FAD, continue with Step 2, below.

2. Insert four PTFE dowel pins into the blue window trim ring.

3. Insert one of the thinner O-rings into the window mounting plate groove.

4. Get the window pane. Orient it so that the engraved text is readable (text side up).

5. Carefully lay the window pane on to the window mounting plate O-ring between the PTFE spacers. Note: It may be a slightly tight fit between the PTFE dowel pins.

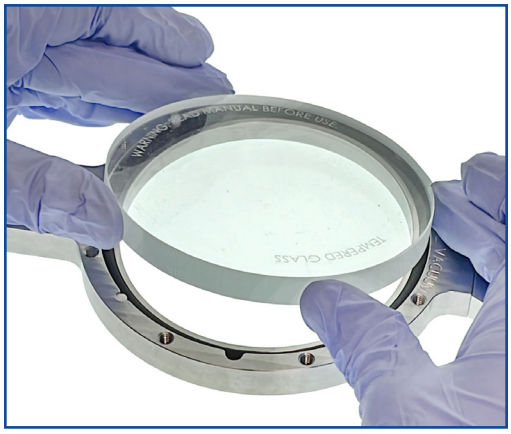


Figure 18 - Place window pane into window mounting plate

6. Insert one of the thinner O-rings into the window trim ring groove.

   If the O-ring is loose in the groove, run it through your hands to create friction to warm and slightly stretch it to fit better. To obtain the optimal seal, avoid twisting the O-ring.

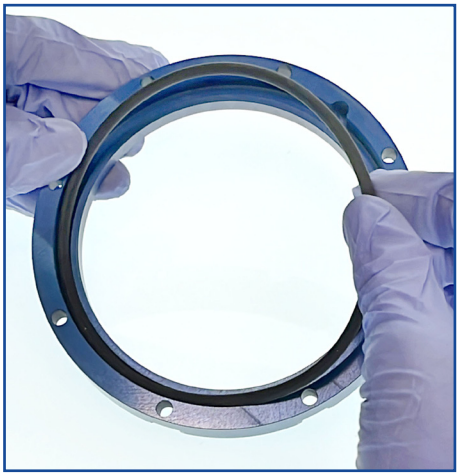


Figure 19 - Insert window trim ring O-ring

7. Carefully place the window trim ring over the window pane and onto the flange, using care to align the screw holes.

8. Insert the 8-32 x 5/8” long window trim mounting screws into each of the holes and begin to tighten using the 9/64”” hex wrench.

   Once the bolts are becoming snug, tighten using a “star” or “cross” pattern, similar to tightening the lug nuts on a car.



Figure 20 - Tighten window trim ring screws using a “star” pattern

9. Use a torque wrench to tighten the bolts to **20 lb-in (maximum)**. When correctly torqued, the window trim ring will contact the ISO flange all around. Overtightening the bolts WILL NOT produce a better seal.

   For information about tightening patterns, download: idealvac.com/files/manuals/Common_Vacuum_Fittings-Selection_and_Assembly_Guide.pdf.

10. Insert the thick O-ring into the groove in the ISO mounting flange.

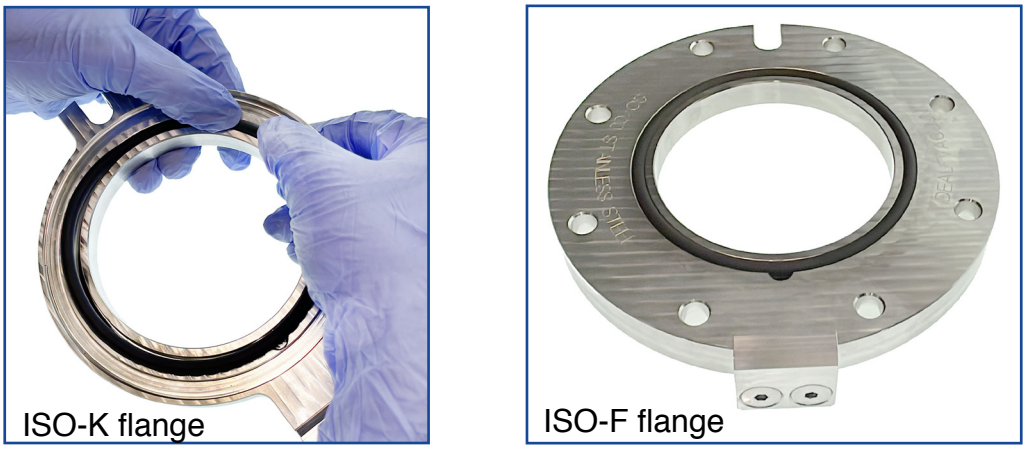


Figure 21 - Insert thick O-ring into ISO mounting flange

11. Slide a washer over the hinge hex bolt.

12. Hold the window assembly above the ISO mounting flange at a small angle so that the hole in the hinge fork aligns with the hole in the flange hinge block.

    Note: The window assembly will not sit flat on the flange because of the O-ring.

13. Slide the bolt through the hinge hole while inserting flat washers between the hinge fork and hinge block.

14. Slide on the last flat washer and thread on the nylon hex nut.



Figure 22 - Insert hinge hex bolt through hinge hole

15. Use two 1/2” wrenches to tighten the hinge bolt.



Figure 23 - Use two wrenches to tighten hinge bolt

16. Adjust the bolt tension so that:

    (1) the window assembly remains in place when it is at an approximate 45 degree angle to the flange, and
    (2) so that it is not extremely hard to open.



Figure 24 - Adjust bolt tension

17. Examine the ISO centering ring and clean or replace it as needed.

18. Remount the FAD on to the chamber or ISO flange.

19. Test for leaks.

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