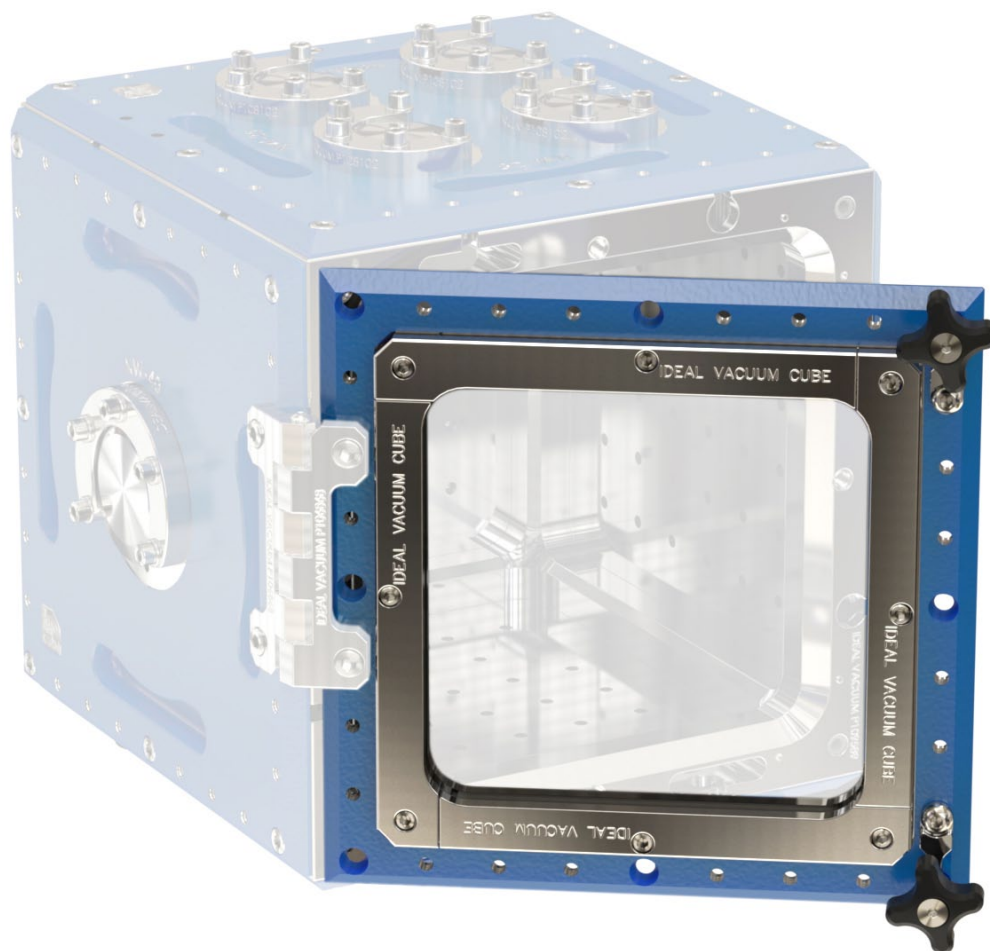




OUR PRODUCTS DEVELOP TOMORROW'S TECHNOLOGIES™

# VIEWING WINDOW ASSEMBLY (VWA)

## USER'S MANUAL



for 6x6, 6x12, 9x9 and 12x12 Ideal Vacuum Cubes

## WARRANTY

Ideal Vacuum warrants, to the original purchaser, this product to be free from defects in workmanship and materials, for a period of one (1) year from the original delivery date. The liability of Ideal Vacuum, under this warranty, is limited to servicing, adjusting, repairing or replacing any unit or component part which, at Ideal Vacuum's sole discretion, is determined to have failed during normal, intended use. This warranty does not cover improper installation, process related damage, product used in any way other than defined in this manual, or any misuse, abuse, negligence, accident, or customer modification to the product. Prior to returning any product, we require that you contact us by phone or email to determine if the issue can be resolved quickly. A technical support representative will try to resolve the problem. If we cannot resolve the issue quickly, we will issue an RMA number and provide product return instructions.

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If you have any questions concerning the installation or operation of this equipment, or if you need warranty or repair service, please contact us. Customer Service and Technical Support is available weekdays, from 8am-5pm, Mountain Time.

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### Cover Image:

- 9x9 Modular Vacuum Cube with Glass Viewing Window (Door Option and Quick Knobs installed)

# 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.



Indicates an imminently hazardous situation that, if not avoided, will result in death or severe injury.



Indicates an imminently hazardous situation that, if not avoided, could result in death or severe injury.



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.



Indicates an potentially hazardous situation that, if not avoided, could result in equipment or property damage.



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 WINDOW ASSEMBLY (VWA)

 **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 for cleaning.

### MOUNTING AND ASSEMBLY



Carefully follow all mounting and reassembly instructions herein 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 GRADIENTS



The fragile nature of the window makes it susceptible to thermal shock. Rapid temperature changes or gradients 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 changes 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 by the window's material. Directing a laser through the window with a wavelength it 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

The Viewing Window Assembly (VWA) is a popular option for Ideal Vacuum Cube modular, high-vacuum, chamber systems which allows a user to inspect chamber processes and perform optical experiments. The VWA is interchangeable with other Cube plates, can be added to an [Ideal Vacuum Cube system](#) at any time and can be implemented as a fixed side, or a door (with [optional door kit](#)). Available sizes are 6x6, 6x12, 9x9 and 12x12.

The VWA consists of a 3/8" thick window pane secured to an aluminum mounting plate using an innovative cushioned design which is less prone to leakage than other viewport window configurations, even at high-vacuum pressures. Unlike other viewports, where the window material is permanently affixed to the mounting fixture (with glue or a bonding agent), the floating window design allows for service and window replacement without having to replace the entire assembly.

Three window materials are available: low-iron, high clarity, tempered glass, Heraeus TSC-3® fused quartz or Corning HPFS® 7980 fused silica. See [Section 1.3](#) for complete assemblies and replacement/upgrade window pane options. See [Section 1.6](#) for an overview of the differences between the three window material types.

The VWA, like all Ideal Vacuum Cube plates, is mounted to the exterior of the Cube frame and does not intrude into valuable chamber volume. The plate is mounted to the Cube and sealed using our patented Taper-Seal™ design, which helps protect vacuum sealing surfaces and O-ring seals from damage or contamination.

All parts that make up the VWA have been carefully selected for vacuum system compatibility and longevity. All production, assembly and testing is done in our own manufacturing facility in Albuquerque, NM, U.S.A. Before it ships, every viewing window 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 - Viewing window assembly sizes. From left: 6x12, 12x12, 9x9 and 6x6*



## 1.2 SPECIFICATIONS

PARAMETER	MEASURE/TYPE
Ultimate Vacuum Pressure	3 x 10 <sup>-8</sup> Torr
Leak Rate	<1 x 10 <sup>-8</sup> std cc/sec atm Helium
Temperature Rating	-20° to 150° C (-4° to 302° F)
Thermal Gradient	10° C/min (18° F/min) max
Materials	
Viewing Window	3/8" thick; glass, fused quartz or fused silica
Mounting Plate	6061-T6 Aluminum
Hold-Downs	6061-T6 Aluminum
O-Ring Seals	Viton®
Standoff Dowel Pins	Teflon® (PTFE)
Spacer Gasket	Teflon® (PTFE)
Frame Hold-Down Bolts	18-8 Stainless Steel, 6-32 x 3/8"
Plate Size	Viewing Area
6x6	8.7 in <sup>2</sup>
6x12	26.7 in <sup>2</sup>
9x9	35.7 in <sup>2</sup>
12x12	80.7 in <sup>2</sup>

Table 1 - Technical specifications

## 1.3 ASSEMBLIES AND WINDOW PANE REPLACEMENTS

CUBE SIZE	LOW IRON TEMPERED GLASS		FUSED QUARTZ (Heraeus TSC-3®)		FUSED SILICA (Corning HPFS® 7980)		WINDOW O-RING
	Complete Assembly	Window Only	Complete Assembly	Window Only	Complete Assembly	Window Only	Viton®
6x6	<a href="#">P106869</a>	<a href="#">P1010572</a>	<a href="#">P1010570</a>	<a href="#">P1010573</a>	<a href="#">P1010571</a>	<a href="#">P1010574</a>	<a href="#">P107295</a>
6x12	<a href="#">P108695</a>	<a href="#">P1010577</a>	<a href="#">P1010575</a>	<a href="#">P1010578</a>	<a href="#">P1010576</a>	<a href="#">P1010581</a>	<a href="#">P108339</a>
9x9	<a href="#">P109976</a>	<a href="#">P1010584</a>	<a href="#">P1010582</a>	<a href="#">P1010585</a>	<a href="#">P1010583</a>	<a href="#">P1010588</a>	<a href="#">P1010490</a>
12x12	<a href="#">P109369</a>	<a href="#">P1010596</a>	<a href="#">P1010594</a>	<a href="#">P1010597</a>	<a href="#">P1010595</a>	<a href="#">P1010598</a>	<a href="#">P108428</a>

Table 2 - Part number selector: assemblies, window and O-ring replacements

## 1.4 ACCESSORIES

A viewing window maintenance and service toolkit is available which has the correct hex wrench (9/64") and an O-ring removal tool: [P1010555](#)

To convert the VWA to a door, use the Hinge Assembly and Hardware kit: [P106868](#).

For faster and easier door access, order the Quick Knob Assembly: [P107936](#).



## 1.5 ASSEMBLY DIAGRAM AND PARTS LIST

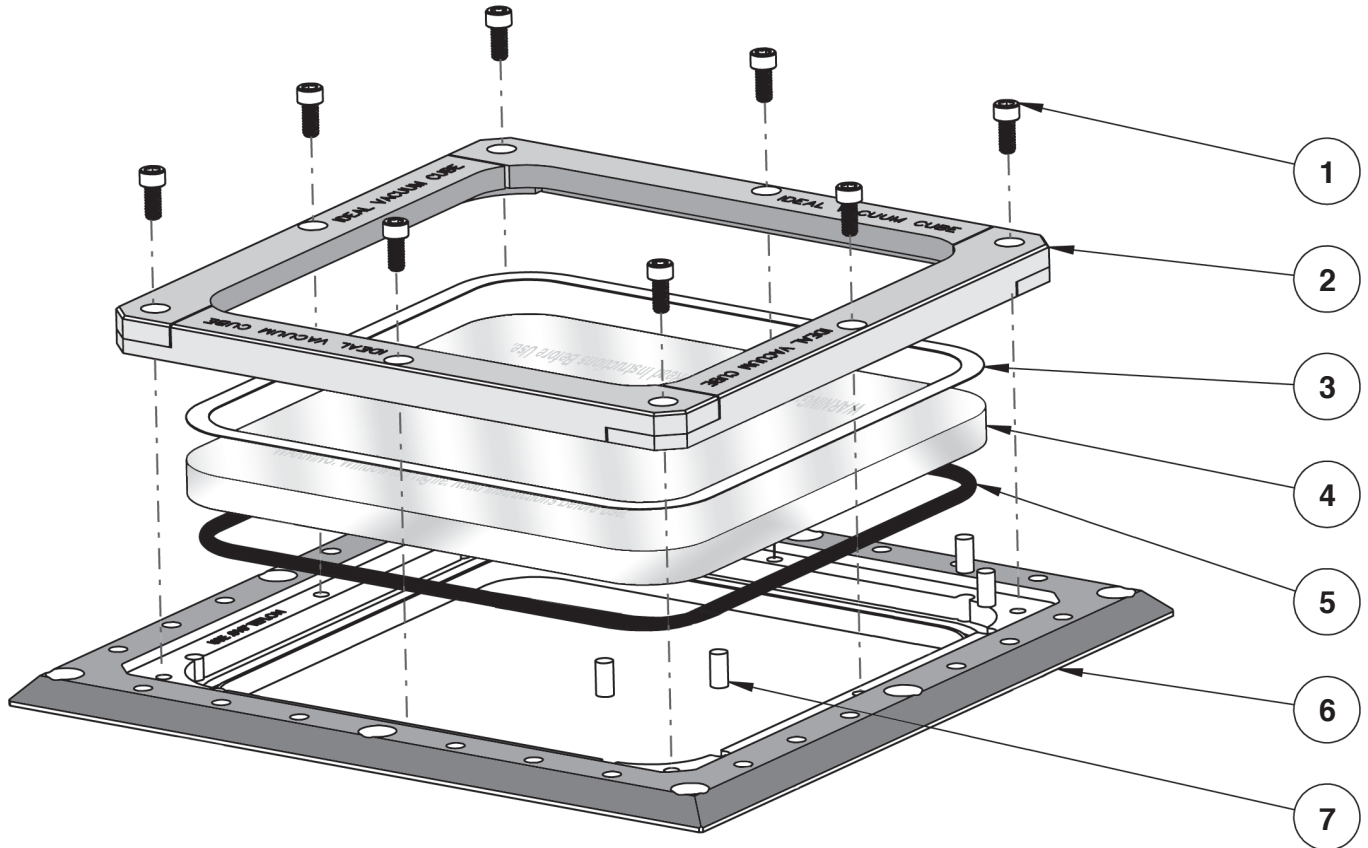


Figure 3 - Exploded view of assembly

ITEM	DESCRIPTION	QTY.
1	Frame Hold-Down Bolt, SS Socket Head, 8-32 x 3/8", <b>Torque = 20 in-lb. Max.</b>	8
2	Window Pane Hold-Down Frame Section, Overlapping, Aluminum	4
3	Gasket/Spacer, Teflon (PTFE), .010" Thick	1
4	Window Pane, with Laser Etched Safety Warning Message	1
5	Window Pane O-Ring, Viton®	1
6	Cube Mounting Plate for Viewing Window, Aluminum	1
7	Window Standoff Dowel Pin, Teflon (PTFE), 3/16" dia. x 3/8" L	8

Table 3 - Viewing window assembly parts list

## 1.6 WINDOW MATERIAL CHARACTERISTICS

We offer three window materials for the VWA: standard glass, Heraeus TSC-3® fused quartz and Corning HPFS® 7980 fused silica. Panes are 3/8" thick. The selection of a suitable window material depends largely on its intended purpose.

Standard window material is a low-iron, high clarity, tempered float glass which has a very slight blueish tint. This glass is the least expensive window material and is most commonly used for general, direct observation of roughing or high-vacuum chamber processes. Standard glass is unsuitable for laser experiments below visible or beyond Near Infrared (NIR) wavelengths.

Our fused quartz and fused silica windows have a scratch-dig grade of 80/50 and are typically used for laser experiments due to their optical clarity and flatness. Both fused materials have appreciably improved transmittance and a wider useful wavelength range than glass.

Figure 2 below shows a comparison of the percent transmission of light (compared to reflection) and the range of wavelengths the three window materials can pass without unreasonable energy absorption. The graph shows that each of the three materials has excellent transmissivity throughout the visible range, with the Corning 7980 fused silica material nearly completely transmissive.

Just below the visible, at approximately 350 nm, standard glass begins to absorb energy significantly. Quartz and silica fused materials do not become overly absorptive until well into the Mid UV ( $\approx 250$  nm) and maintain excellent transmissivity up to the Mid IR ( $\approx 2100$  nm).

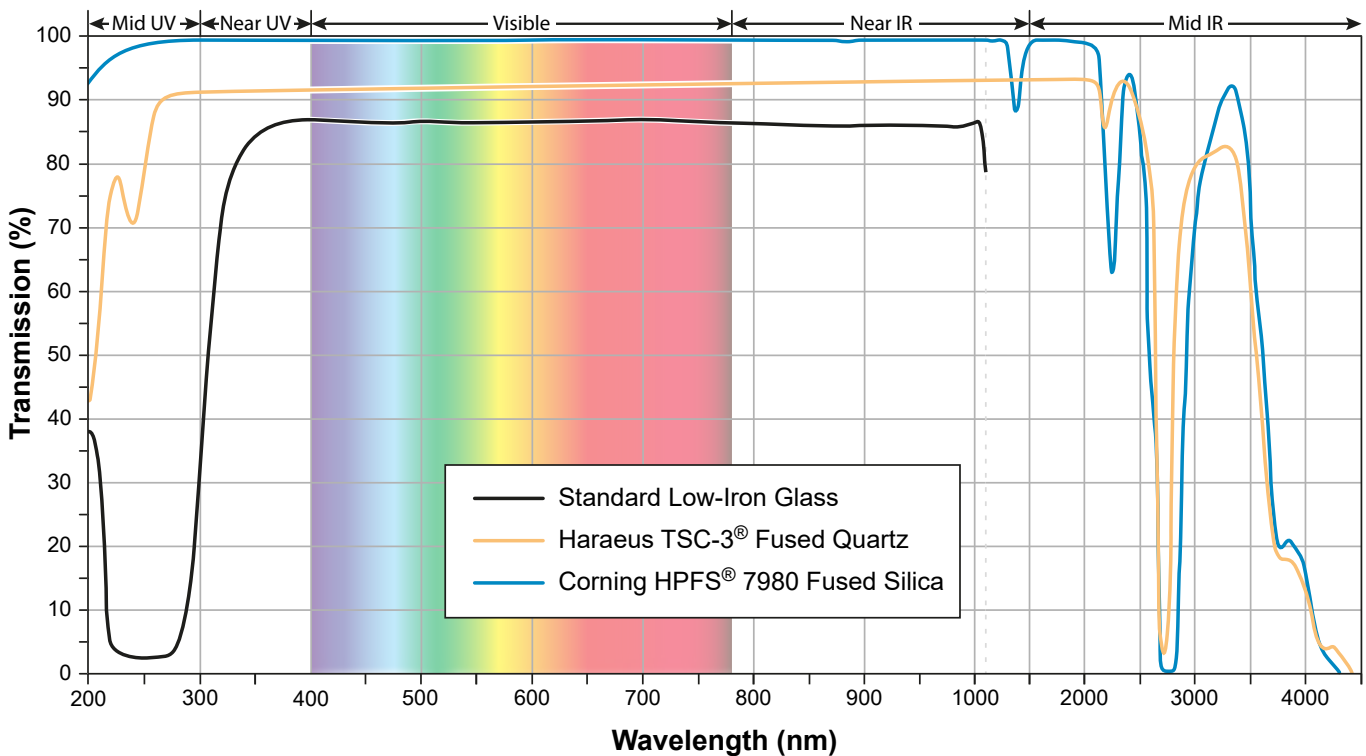


Figure 2 - Transmissivity of viewing window materials

## 2. WINDOW PANE SERVICE, REPLACEMENT AND UPGRADES



The VWA and window pane materials are engineered with critical tolerances. Use only factory certified windows.

Occasional cleaning and servicing of the VWA is beneficial to maintain good operation. Particulates and other contaminants could begin to accumulate on the window pane causing reduced transparency. The O-ring seal could begin to harden or deteriorate over time, resulting in poor sealing and requiring O-ring replacement. Inspect the VWA regularly as part of scheduled, system preventive maintenance.

If the VWA begins to leak, it may simply require re-torquing the hold-down frame bolts (see [Section 2.3](#)). **Maximum torque is 20 in-lb.** Over-tightening of bolts DOES NOT produce a more leak-proof seal. Overtightening could cause internal strain buildup in the window material resulting in failure.

Disassembly is required for any of these reasons:

1. If tightening the bolts does not eliminate a leaky seal.
2. If the window pane becomes scratched or can not be successfully cleaned.
3. If a window replacement or upgrade is needed or desired.

The design of the VWA allows the window pane to be factory or field serviced and the window pane material can be replaced or upgraded whenever system needs change. [Table 2](#) shows all available window assemblies, replacement window panes and O-rings.

**We strongly encourage a window pane replacement or upgrade be performed at our facility, as compared to in the field.** This ensures the VWA is correctly serviced, properly helium leak tested and safe for continued use.

### NOTE

Included with any window pane purchase (glass, fused quartz or fused silica) we offer free factory window replacement service.

When you purchase a new window, just let us know (by phone or email) that you'd like us to replace, test and re-certify the window for you. We will provide an RMA and return shipping label for you to send us your viewing window plate assembly. Once we receive it, we will disassemble, clean, replace O-rings and any other parts that are not within tolerance, reassemble with the new window pane, helium leak test and ship the completed, updated assembly back to you along with your old window.

*If you have an older viewing window plate assembly (which does not have a bare aluminum window frame), we will upgrade the entire assembly to this latest, more robust and leak resistant version, when replacing the window. Old plate assemblies will not be returned.*

## 2.1 DISASSEMBLY

### WARNING

Before performing any maintenance or service on the Viewing Window Assembly, the Cube chamber must be brought up to ambient atmosphere.

### NOTICE

Prepare a clean, soft surface before performing any maintenance or service on a Viewing Window Assembly. The window is more fragile than many vacuum components. Use an increased level of care and use only clean tools and recommended cleaning agents to perform maintenance, cleaning and service.

The Viewing Window Plate Assembly should be removed from the Cube frame prior to any maintenance or service. Go to the [Ideal Vacuum Cube Manual](#) for specific instructions for removing the Viewing Window Plate Assembly from the Cube frame. We offer a Cube plate maintenance toolkit for this purpose: [P1010554](#), and a complete Cube essential service tool kit, [P1010558](#).

Once the VWA plate is unmounted from the Cube frame and placed on a clean, soft surface, the window pane frame mounting bolts may be removed. **Use a 9/64" hex wrench.**

Starting with the corner bolts and using a “star” or “cross” pattern as shown in Figure 3 below, loosen one bolt, then one opposite from it (similar to removing the lug nuts on a car). Unscrew bolts gradually (about a 1/2 turn at a time) and take several “passes” until all bolts are free.

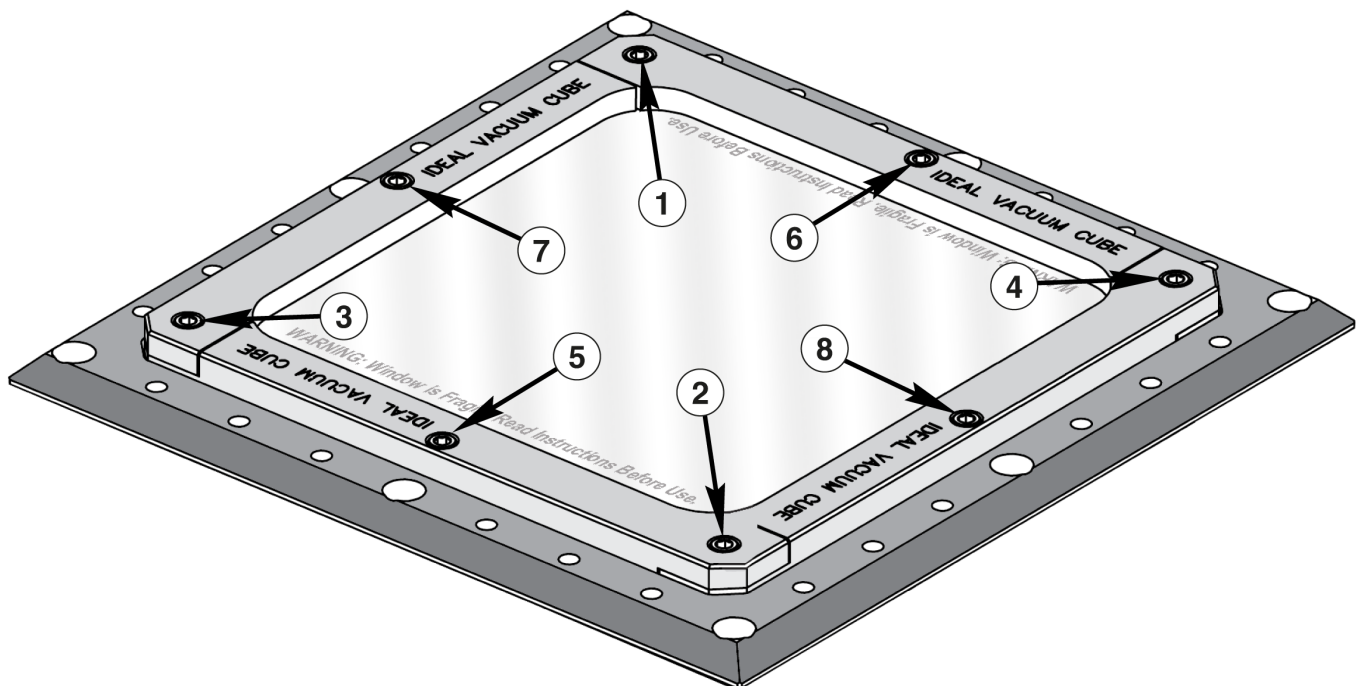
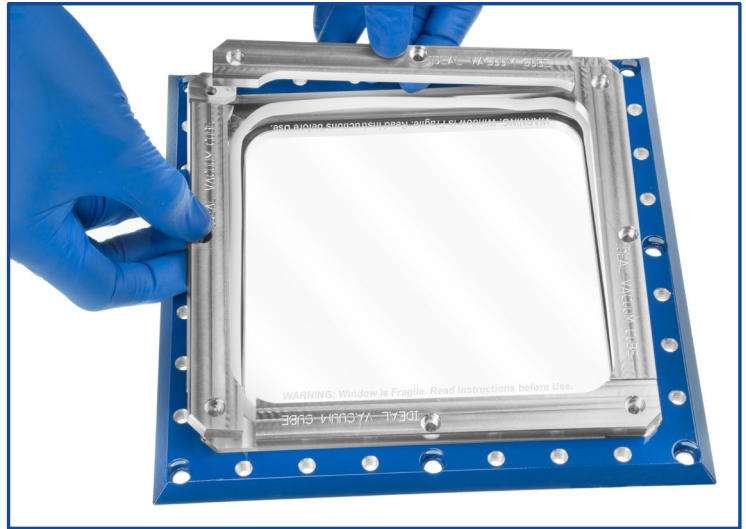


Figure 3 - Pattern for loosening window frame mounting bolts

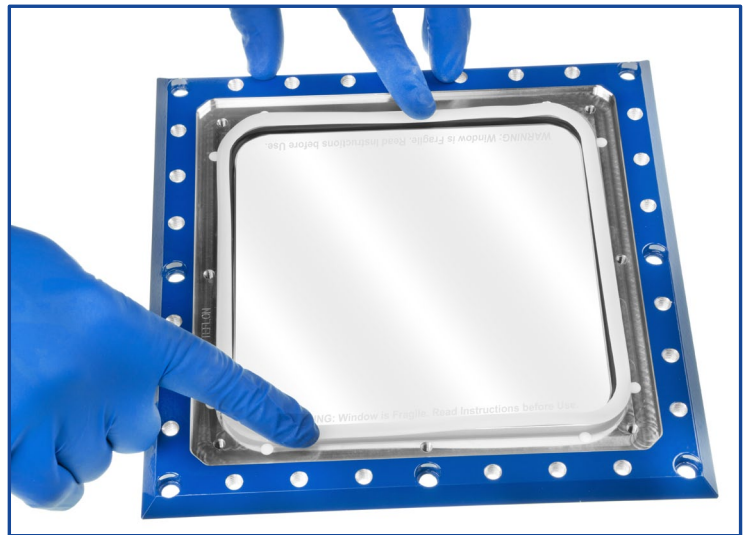
1. After removing the frame hold-down bolts, remove the four overlapping aluminum window pane hold-down frame sections. Use care not to scratch the window material.



*Figure 4 - Remove the four window frame sections*

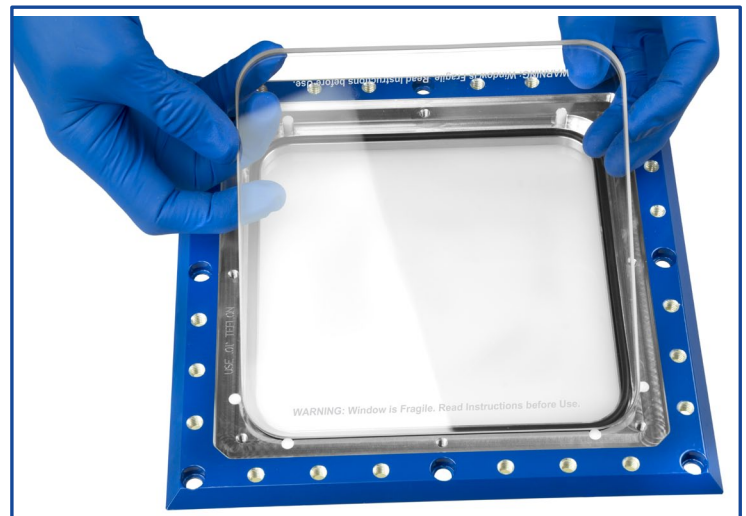
2. Lift off the thin Teflon spacer gasket.

**Note:** Some window assemblies do not use or require a Teflon gasket. If the assembly does not have a Teflon gasket, proceed to step 3, below.



*Figure 5 - Remove the Teflon gasket*

3. Carefully remove the window pane from the plate and place it gently on the clean, soft surface.



*Figure 6 - Remove the window pane*



## 2.2 MAINTENANCE AND SERVICE

Once the window pane has been removed from the assembly, all the parts can inspected, cleaned and replaced as necessary.

Use a soft, clean, lint-free cloth and isopropyl alcohol (IPA) to clean the aluminum plate and frame sections.

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

Use a plastic O-ring removal tool (Figure 7, [P1010547](#)) to carefully remove the window pane O-ring. (Figure 8). Do not use a metal tool which could damage the O-ring or the O-ring groove.



*Figure 7 - O-ring removal tool*

We offer a viewing window toolkit, [P1010555](#), which has the correct 9/64" hex wrench and an O-ring removal tool (shown above) needed for maintaining and servicing the VWA.



*Figure 8 - Remove the window O-ring*

Inspect the O-ring for any damage. If the O-ring is not pliable or is permanently deformed, then it must be replaced (see [Section 1.3](#) for replacement O-rings). Otherwise it can be reused.

Wipe the O-ring groove with IPA before reinstalling or installing a new O-ring. Do not use vacuum grease on the O-ring.

## 2.3 REASSEMBLY

Reassemble the Viewing Window Plate Assembly in reverse order to disassembly:

1. Install the O-ring (new or reused). Push it into the groove with your fingers. If the O-ring pops out of the groove, run it through your hands to create friction to warm and slightly stretch it to fit better.
2. Gently place the window pane (existing or a replacement/upgrade) onto the O-ring and between the Teflon dowel pins (two in each corner of the plate, illustrated by arrows in Figure 7). Align the pane so it does not touch metal when being lowered into place. Be careful not to drop the pane onto the plate. Notice that the pane fits loosely in the plate recess. This is correct.

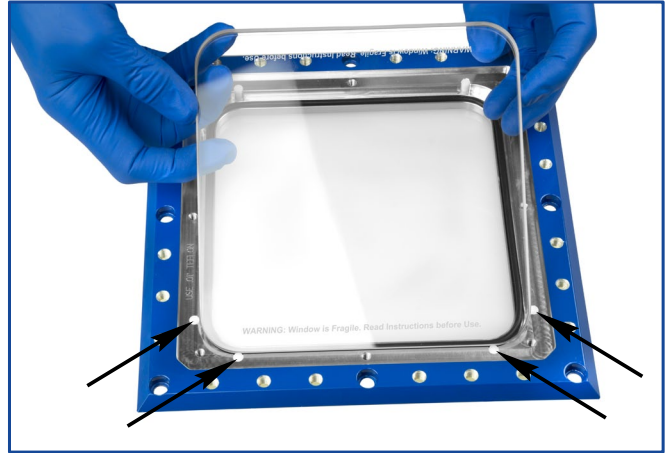


Figure 9 - Place the window pane

3. Replace the teflon spacer gasket back onto the window pane. The corners should line up with the window pane corners.

**Note:** Some window assemblies do not use or require a Teflon gasket. If the assembly does not have a Teflon gasket, proceed to step 4 below.

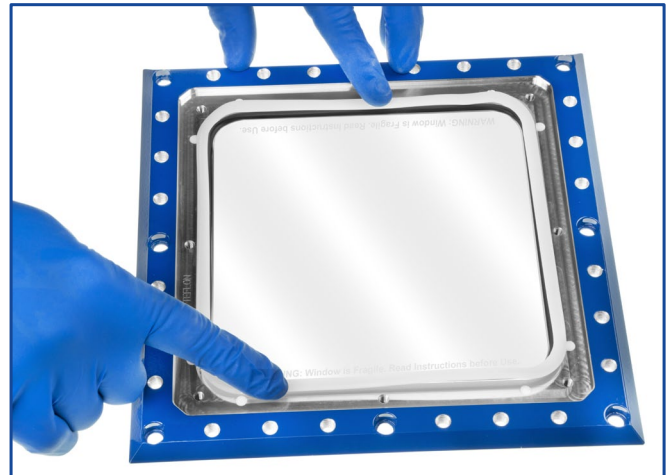


Figure 10 - Replace the Teflon gasket

4. Fit the four aluminum window hold-down frame sections onto the window and teflon gasket. Notice that each frame section fits under one side and overlaps the other side of the next frame section.

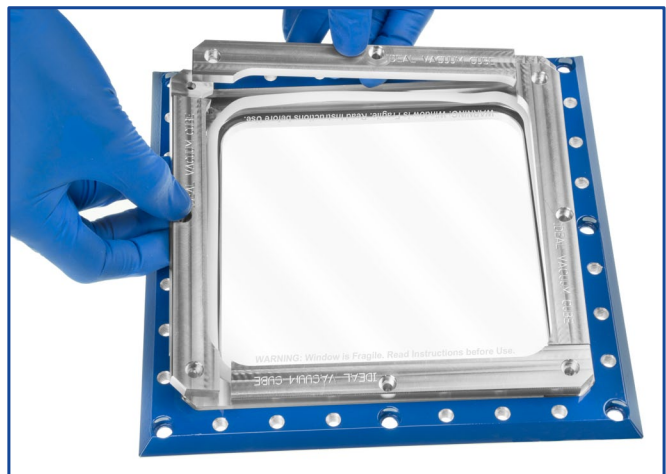
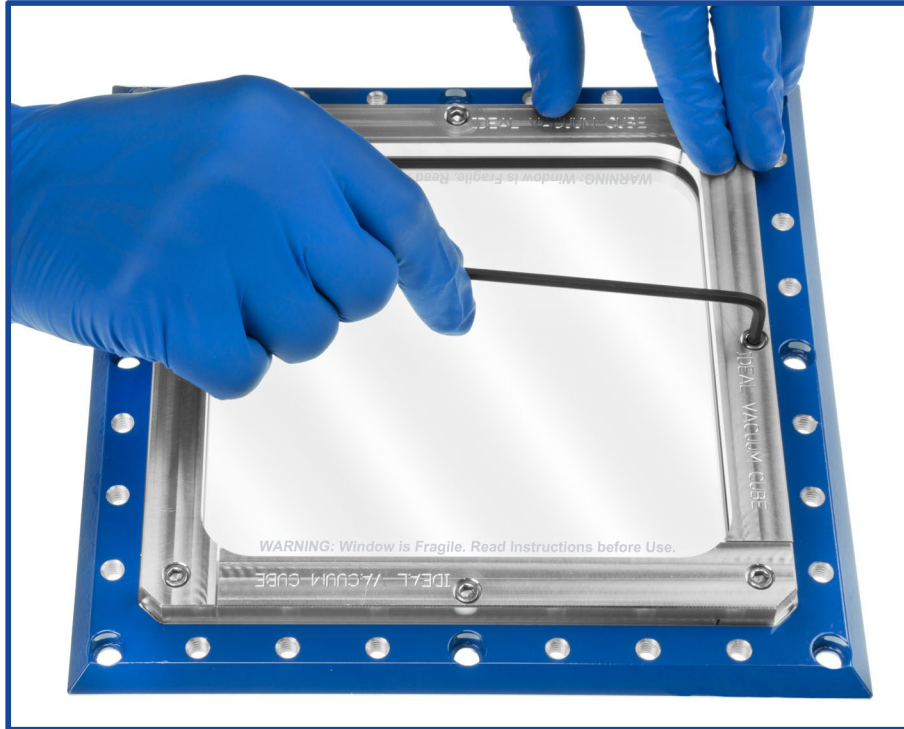


Figure 11 - Fit the four window frame sections

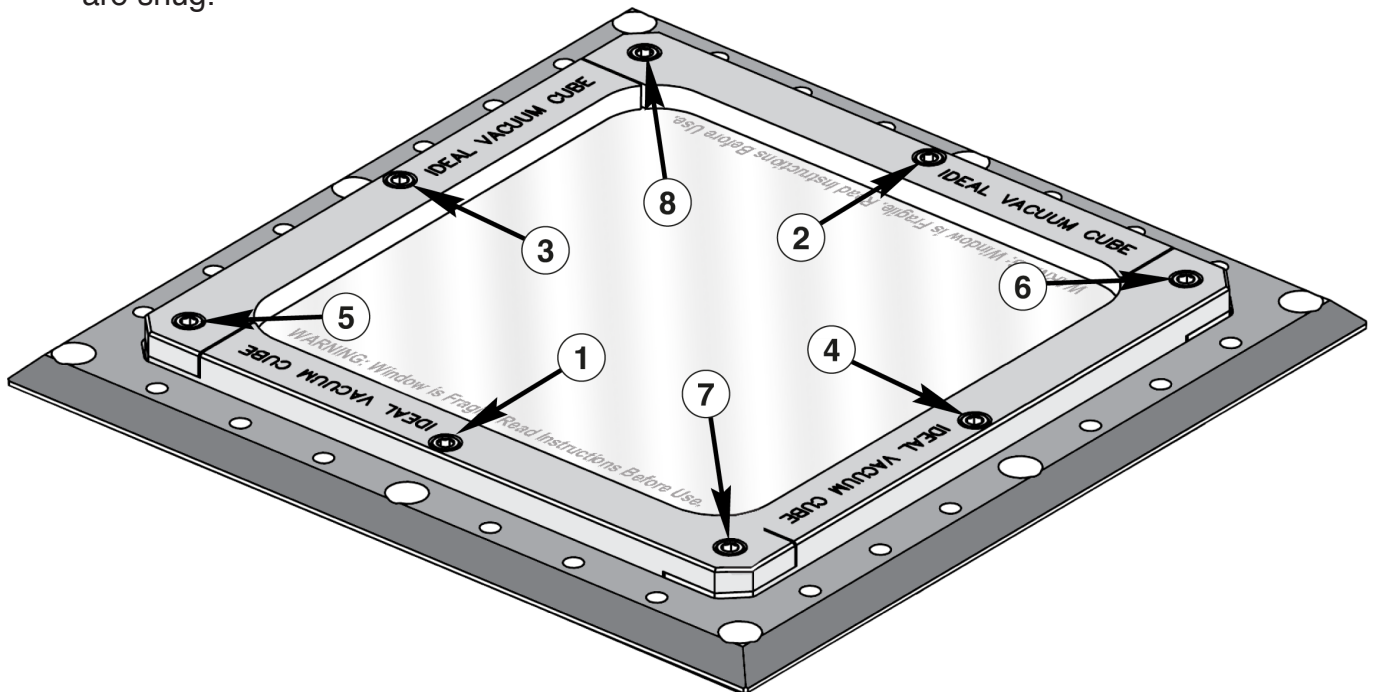


5. Replace the 8-32 x 3/8" bolts in each of the frame bolt holes.
6. Use the 9/64" hex wrench to begin tightening the window frame bolts:



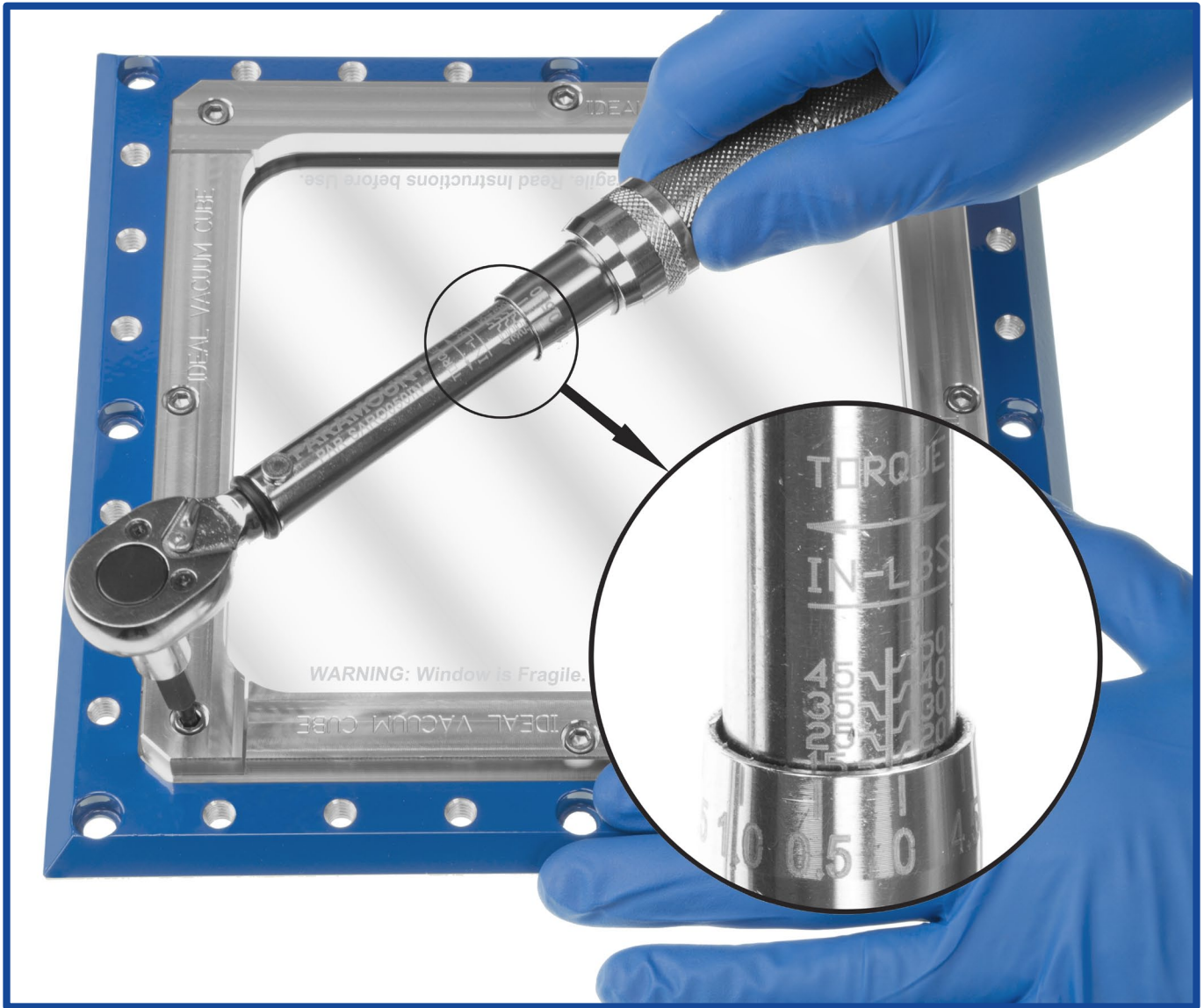
*Figure 12 - Begin to tighten the window frame bolts*

7. Starting with the center bolts and using a “star” or “cross” pattern as shown in Figure 13 below, tighten one bolt, then one opposite from it (similar to tightening the lug nuts on a car). Tighten bolts gradually (about a 1/2 turn at a time) and take several “passes” until all bolts are snug.



*Figure 13 - Pattern for tightening window frame bolts*

8. Finish tightening the window frame bolts using a torque wrench set to **20 in-lb.** (maximum).  
Continue around the star pattern until all bolts have been properly torqued:



*Figure 14 - Torque window frame mounting bolts to 20 in-lb.*

9. Reassembly of the VWA is complete. Remount the Viewing Window Assembly Plate onto the Cube frame.

Follow the instructions in the [Ideal Vacuum Cube Manual](#) for specific instructions and bolt torque specifications for installing the Viewing Window Plate Assembly onto the Cube frame.

## 2.4 FACTORY ASSISTANCE

Please contact the Ideal Customer Support Team to assist you with any issue regarding the Viewing Window Plate Assembly. We are here to help.

[Customer Service](#) and [Technical Support](#) is available weekdays, from 8am-5pm, MST.



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