Ideal® vacuum

OUR PRODUCTS DEVELOP TOMORROW'S TECHNOLOGIES™

NON-ILLUMINATED HALO VIEW WINDOW SYSTEM (HVW)

USER MANUAL

ISO-63, 80, 100, 160, 200 & 250 Viewing Windows

HVW-09252023 - V 1.3.2

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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 HALO VIEW WINDOWS (HVW)

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

The non-illuminated HALO View Window System (HVW) is a popular accessory for Ideal Vacuum Cube and other vacuum chamber systems with ISO ports. HALO View windows are used in place of blank ISO-K flanges and allow a user to inspect chamber processes and perform optical experiments. An HVW can be added to a system at any time.

HALO View windows are available in ISO 63, 80, 100, 160, 200 and 250 flange sizes. Like other ISO-K fittings, these ISO flanged windows use either single or double claw clamps along with a centering ring fitted with an O-ring. Use double claw clamps to mount to other ISO-K flanges. Use single claw clamps to mount to ISO-F flanges with bolt holes (smooth bored or threaded), such as those used on Ideal Vacuum Cube chamber plates. The recommended number and type of claw clamps and the centering ring required is shown in Table 3, Sec. 1.4, p. 8.

For information about how to properly mount ISO-K fittings, please download:

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

Two window materials are available: tempered glass and fused silica. See Sec. 1.3, p. 7, for complete HVW assemblies and replacement/upgrade window pane options. See SeC. 1.6, p. 9, for for material characteristics and suggested uses of the two window material types.

HVW's employ a zero metal-to-glass contact design that holds a 3/8" thick window pane to a stainless steel ISO-K type mounting flange. This cushioned window mounting system ensures operator safety and window longevity. The simple construction makes the non-illuminated HVW field serviceable.

Ideal Vacuum ISO HALO View windows employ Viton O-rings and PTFE spacers. This allows bakeout temperatures of the non-illuminated HVW to 150°C.

All parts that make up the HVW are 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 HALO 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 - HALO View windows. From left: ISO-63, 80, 100, 160, 200

We also offer illuminated HALO View windows. Please visit:
https://www.idealvac.com/HALO-Window-Viewports/ct/2-92-1669

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 Anodized Aluminum	
ISO-K Flange	304 Stainless Steel	
O-Ring Seals	Viton®	
Dowel Pin Spacers	PTFE, 3/16” x 3/8” L	
Trim Ring Hold-Down Bolts	18-8 Stainless Steel, 8-32 x 9/16” L	
Window Size	**Viewing Diameter**	**Viewable Area**
ISO-63	2.1 in.	3.5 $in.^2$
ISO-80	2.6 in.	5.3 $in.^2$
ISO-100	3.4 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 ASSEMBLIES, WINDOW PANES AND REPAIR/REBUILD KITS

WINDOW SIZE	LOW IRON TEMPERED GLASS		FUSED SILICA (Corning HPFS® 7980)		REPAIR KIT
	Complete Assembly	Window Only	Complete Assembly	Window Only	Includes (2) Viton® O-Rings & (4) PTFE Spacers
ISO-63	P1011599	P1011883	P1012391	P1012373	P1011895
ISO-80	P1011600	P1011884	P1012392	P1012374	P1011896
ISO-100	P1011601	P1011885	P1012393	P1012375	P1011897
ISO-160	P1011602	P1011886	P1012394	P1012376	P1011898
ISO-200	P1011603	P1011887	P1012395	P1012377	P1011899
ISO-250	P1011604	P1011888	P1012396	P1012378	P1011900

Table 2 - Part number selector: assemblies, pane replacements, and repair kits

1.4 CLAW CLAMPS AND CENTERING RINGS

HALO View ISO window flange bolts, including claw clamp bolts, should be torqued to 7-10 lb-ft. or until the centering ring makes contact with the flanges. There will be a small gap between the flange faces when torqued to the correct tightness.

FLANGE SIZE	MIN. # CLAMPS	OPTIMAL # CLAMPS	DOUBLE CLAW	SINGLE CLAW	CENTERING RING
ISO-63	3	4	P104066	P108058	P101761
ISO-80	4	8	P104066	P108058	P101762
ISO-100	4	8	P104066	P108058	P101763
ISO-160	4	8	P104067	P104065	P101764
ISO-200	6	12	P104067	P104065	P101765
ISO-250	8	12	P104067	P104065	P105424

Table 3 - Part number selector: claw clamps and centering rings

1.5 ASSEMBLY DIAGRAM AND PARTS LIST

Window trim ring hold-down bolts are torqued to 20 lb-in. maximum using a “star” or “cross” tightening pattern. For information about tightening patterns, please download: idealvac.com/files/manuals/Common_Vacuum_Fittings-Selection_and_Assembly_Guide.pdf.

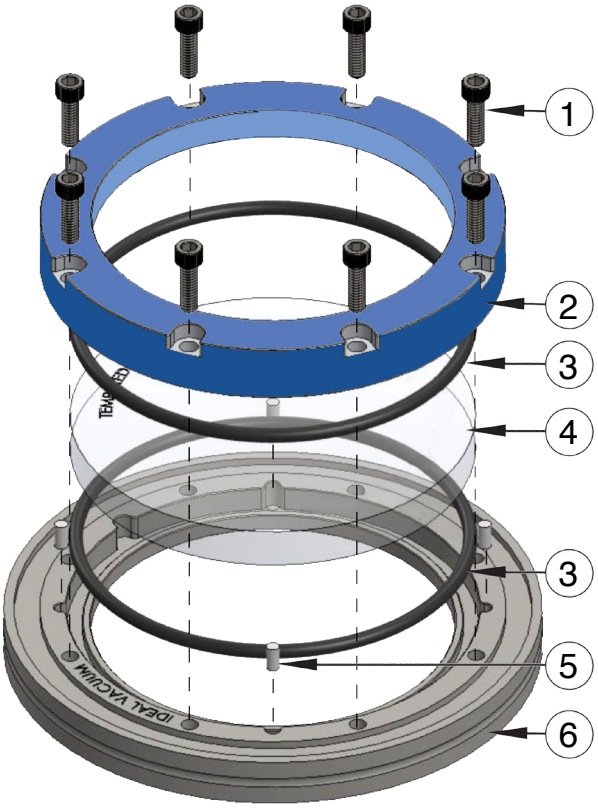

Figure 2 - Exploded view

ITEM	DESCRIPTION	QTY.
1	Hold-down Bolts	4 - 16 (depends on ISO size)
2	Window Trim Ring	1
3	Viton O-ring	2
4	Window, Tempered Glass or Fused Silica w/Etched Warning Message	1
5	Dowel Pin Spacer	4
6	Window Flange	1

Table 4 - Assembly parts list

1.6 WINDOW MATERIAL CHARACTERISTICS

The selection of a suitable window material depends largely on its intended purpose. We offer two window materials for HALO View Windows: standard low-iron tempered float glass and high purity fused silica (comparable to Corning HPFS 7980). Both types are polished plate material.

Our high clarity, tempered window glass 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 we offer 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 in-vacuo processes by direct observation. This glass is not suitable for high power laser experiments.

Our high purity fused silica windows are 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.

Figure 2, 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.

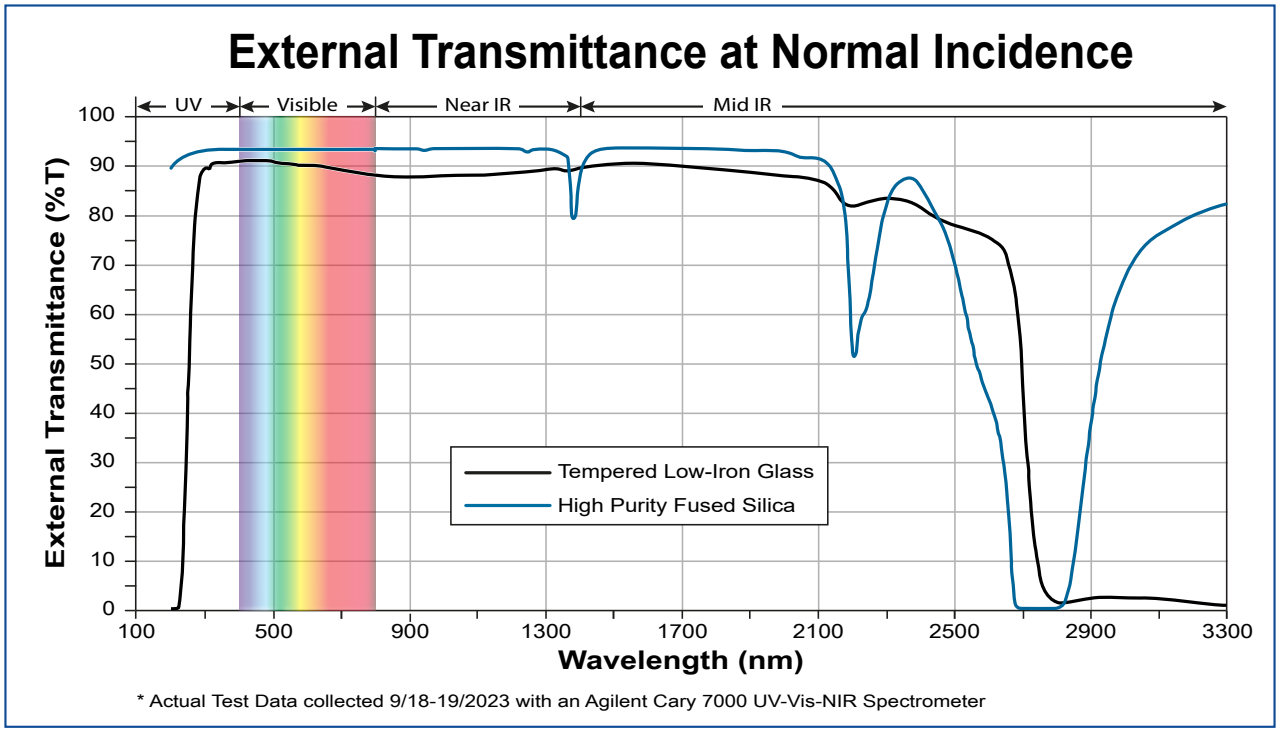

Figure 3 - External transmittance of tempered glass and fused silica at normal incidence

2. WINDOW PANE SERVICE AND REPLACEMENT

⚠WARNING

HALO View Windows and window pane materials are engineered with critical tolerances. Use only factory certified windows.

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

Disassembly may be required for any of these reasons:

1. If the window pane becomes scratched or can not be successfully cleaned.
2. If a window replacement or upgrade is needed or desired.

The design of the non-illuminated HVW allows the window pane to be replaced or upgraded whenever system needs change. Table 2, Sec. 1.2, p. 7, shows the available viewing window assemblies, replacement window panes and repair kits.

2.1 DISASSEMBLY AND MAINTENANCE

⚠WARNING

Before performing any maintenance or service on the HALO View Window, the vacuum chamber must be at ambient atmosphere.

NOTICE

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

The HALO view window is demountable, meaning that the window pane can be removed while the assembly flange remains connected to the chamber's ISO flange. However, we recommend you remove the HALO View Window assembly from the vacuum chamber prior to maintenance or service. Depending on the ISO flange size of the window, a 1/2", 13 mm or 17 mm wrench is required to remove the claw clamps.

All non-illuminated HALO View windows are constructed similarly to the example in Figure 2, Sec. 1.5, p. 8. Each window size has a different number of trim ring hold-down bolts.

1. **Using a 1/8" hex wrench**, gradually unscrew the trim ring hold-down bolts. Use a "star" or "cross" pattern so as not to warp the trim ring. Take several "passes" around the ring until all bolts are free. Once all bolts are loose, the ring is lifted off the flange easily (Figure 4).

Figure 4 - Remove the trim ring with bolts still inserted

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

3. Use a plastic O-ring removal tool, like the one shown in Figure 5 (P1010547), to carefully remove the O-rings from their grooves in the trim ring and ISO flange. Do not use a metal tool which could damage the O-ring or the O-ring groove.

Figure 5 - O-ring removal tool

Both the ISO flange and the trim ring have specially machined recesses for easy O-ring removal (Figure 6).

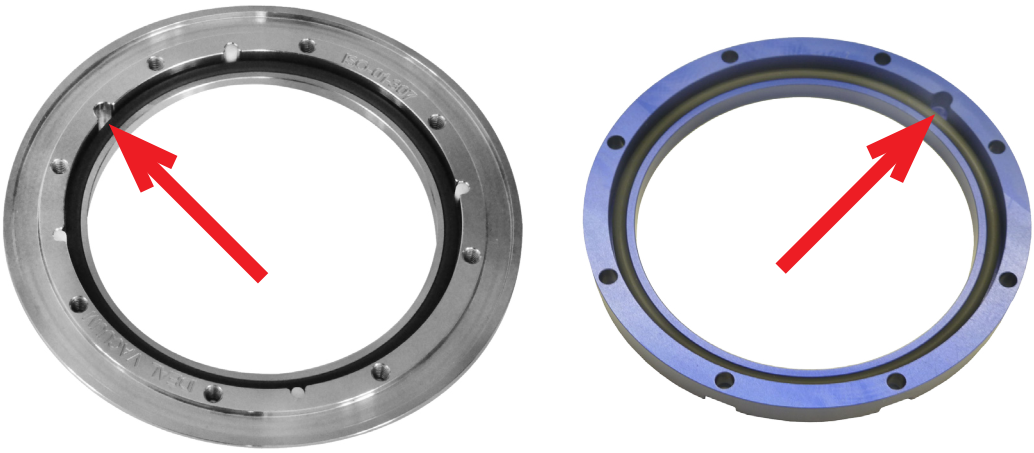

Figure 6 - O-ring removal recesses

4. Inspect the (4) PTFE dowel pin spacers.

5. Inspect the O-rings for damage. They can be reused as long as they remain pliable and are not permanently deformed. See Table 3, Section 1.3, page 7, for repair/rebuild kits. Each kit contains two Viton O-rings and four PTFE dowel pin spacers.

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

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

2.2 REASSEMBLY

Reassemble the HALO View window assembly in reverse order to disassembly.

1. Insert O-rings into the grooves of the ISO flange and trim rings. Do not use vacuum grease.

   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. To obtain the optimal seal, avoid twisting the O-ring.

   2. Gently place the window pane onto the ISO flange, centered on the O-ring.

   The glass will fit loosely within the PTFE dowel pins. The engraved text on the glass should be face up so that it is readable (Figure 7).

Figure 7 - Window pane placed onto flange

3. Carefully place the window trim ring onto the flange, around the window pane and align the bolt holes.

4. Insert the 8-32 x 9/16” long bolts into each of the holes and begin to tighten using the 1/8” hex wrench.

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

5. 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.

6. Examine the ISO centering ring and replace it as needed when reinstalling the HVW onto the chamber flange.

Figure 8 - Tighten hold-down bolts

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