

Vacuum Chambers

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Equipment Source

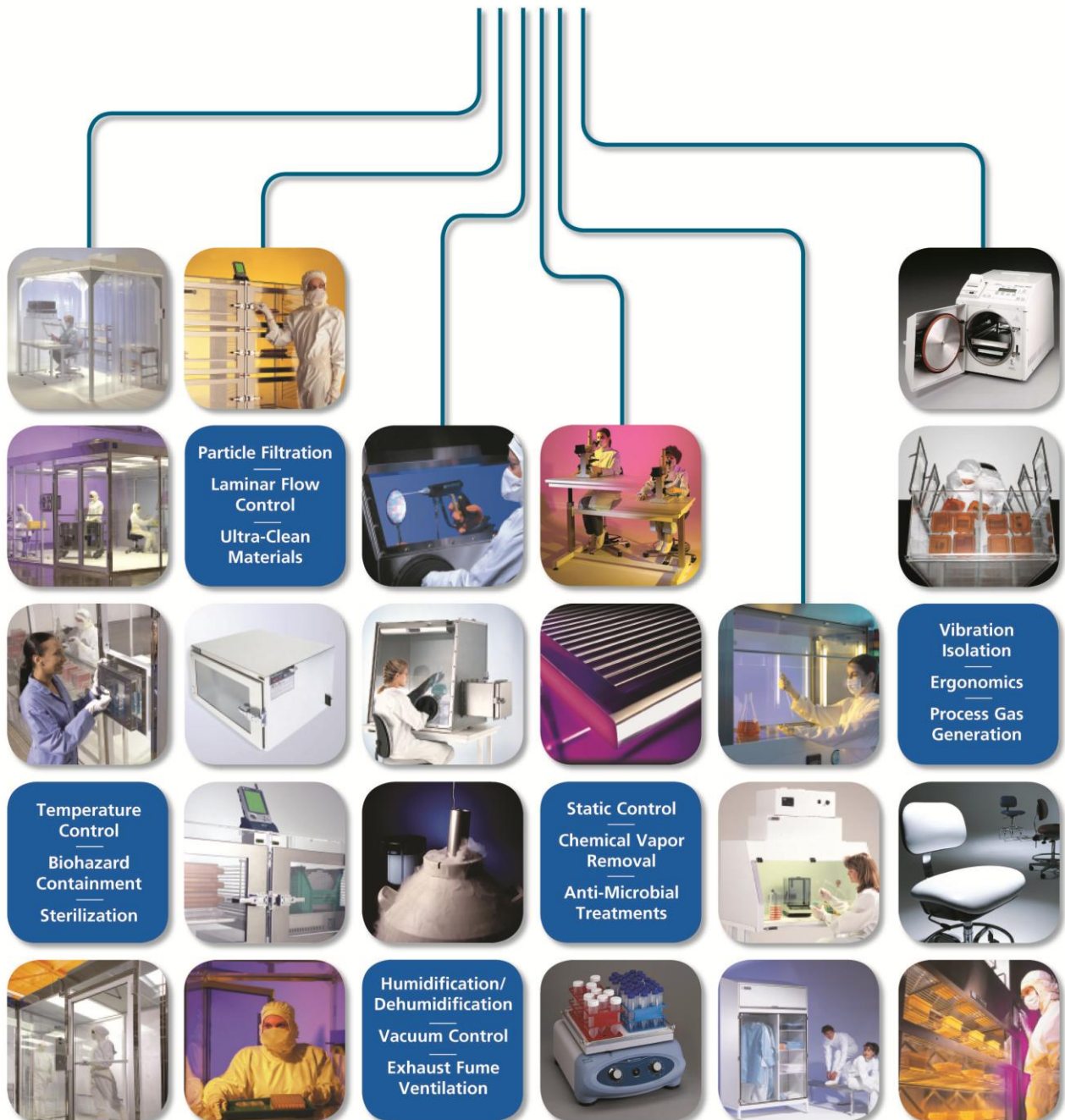




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1. Safety

Proprietary Notice

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Safety Notice

A thorough familiarity with all operating guidelines is essential to safe operation of the product. Failure to observe safety precautions could result in poor performance, damage to the system or other property, or serious bodily injury or death. The following symbols are intended to call your attention to two levels of hazard involved in operation.



CAUTION

Cautions are used when failure to observe instructions could result in significant damage to equipment.



WARNING

Warnings are used when failure to observe instructions or precautions could result in injury or death.

The information presented here is subject to change without notice.

To reduce the risk of fire, electric shock, or injury to persons, observe the following:



CAUTION

- Use proper lifting and moving equipment when moving the vacuum chamber.
- Do not move the vacuum chamber during operation.
- Do not use this vacuum chamber in a contaminated atmosphere or where metallic dust exists.
- Do not expose the vacuum chamber to any heat sources.
- Do not use isopropyl alcohol, chlorine bleach, ammonia-based cleaners, abrasives, ammonia, or metal scouring pads.
 - Wipe with a soft damp cloth or a sponge soaked in water or diluted neutral detergent.
- Do not hit or collide the vacuum chamber with other objects, especially sharp objects such as knives or screwdrivers.
- Acrylic vacuum chambers cannot be autoclaved.

Critical Operation Conditions



WARNING

- **Never install or use this unit in explosive atmospheres.**
- **Never install this unit near hazardous or flammable substances.**
- **Wear impact-resistant safety glasses at all times.**
- **Vacuum chamber is designed for negative pressure. For applications that use positive pressure, make sure the chamber has a pressure relief valve to prevent a rupture from over-pressurizing the chamber.**



2. General Description

All of Terra's vacuum chambers include two metering valves installed on the chamber. One valve can be used to apply vacuum from a pump while the other valve can be used to backfill the chamber with nitrogen or other process gas. A vacuum gauge reads the pressure levels inside the chamber within a range of 0 – 30"Hg.

Acrylic Vacuum Chambers

Acrylic vacuum chambers are available in various sizes, with both cubic and cylindrical designs. All models are fabricated of transparent 1"-thick acrylic (except for #5235-08, which uses ½" acrylic). Chrome-plated latches and stainless steel hinges are durable and resist corrosion.

Acrylic models feature O-rings inlaid in a precision CNC-routed channel to ensure a uniform seal along the entire perimeter of the chamber opening. These models are ideal for degassing small parts and mixed liquids, vacuum encapsulation, and general purpose vacuum experiments.

Aluminum Vacuum Chambers

Powder-coated aluminum vacuum chambers offer better chemical resistance than acrylic chambers, particularly when using disinfectants, such as isopropyl alcohol, or sporicidal agents.

Metallic walls also minimize the amount of moisture within the vacuum chamber. Acrylic walls absorb moisture from the air which is then drawn out of the walls when vacuum is applied, leading to a loss of vacuum over time. Several vacuum cycles may be needed to remove all the residual moisture.

If feed-throughs for wiring or electrodes are needed, aluminum is easier to machine and modify for these applications. Acrylic is more prone to cracking, which may develop into leaks over time.



Figure 1. Acrylic vacuum chamber



Figure 2. Aluminum vacuum chamber



Stainless Steel Vacuum Chambers

Stainless steel vacuum chambers feature double-wall construction and the smoothest interior surfaces, making these chambers both very durable and easy to clean. The versatile stainless steel construction is chemical resistant, heat resistant, and ESD-safe, making it useful for a wider range of chemical processing and curing operations. These chambers are also ideal for contamination-sensitive applications – will not permeate or outgas like acrylic designs.

The 8" by 8" window offers a view of the materials inside and is made of heat-resistant safety glass. Handles are installed on the sides of the chamber for easy transport. The silicone gasket ensures a tight seal and provides excellent chemical resistance.



Figure 3. *Stainless steel vacuum chamber*



3. Operation

3.1 Unpacking

Terra's Vacuum Chambers are shipped fully assembled. Uncrate the vacuum chamber, checking to make sure that there is no visible damage incurred during shipment. If damage is found, contact the freight company to file a damage claim immediately.



CAUTION

- Do not form a vacuum when airtight containers are inside the unit.
- Use proper O-rings and nuts when attaching other equipment or additional valves for tight sealing.
- Cool high-temperature samples thoroughly before inserting into the chamber or ensure the samples are not in direct contact with the interior of the unit to avoid interior damage.

3.2 Applying Vacuum to the Chamber



CAUTION

- Do not impact or drop the unit when a vacuum is formed inside.
- When forming or releasing a vacuum, turn the valve handle slowly to avoid rapid pressure change. If not, the stored samples can be damaged or dispersed.
- Do not let the body of the unit into direct contact with isopropyl alcohol, acetone, benzene, toluene, chloroform, cresol, sodium hydroxide, highly concentrated nitric or sulfuric acid, acetic acids, or strong chlorine-based solvents.
- When a vacuum is formed inside the unit, do not apply excessive force to the valves, the vacuum gauge, or any of their vicinities. Any damages caused by external forces can cause unit malfunction.



WARNING

- **For applications that backfill the vacuum with nitrogen gas, take extra caution to avoid over-pressurization. Pressurized systems hold a great deal of energy. Over-pressurizing a chamber can cause adverse effects such as a rupture.**
- 1) Make sure that both metering valves are fully closed.
 - 2) Connect ¼" vacuum line from the vacuum pump to one of the metering valves on the vacuum chamber and open that valve.
 - 3) Turn on the vacuum pump. The vacuum gauge should indicate falling pressure inside the vacuum chamber.
 - 4) Once the desired vacuum level is reached, close the metering valve that is connected to the pump.
 - 5) Turn off the vacuum pump.



WARNING

- **Never turn off the vacuum pump while the vacuum valve is open! Contaminants – including oil, if the pump is oil lubricated – will be drawn into the chamber. Always close the metering valve before turning the pump on or off.**

Note: Achieving maximum vacuum will vary depending on several factors, including pump capacity, chamber size, material thickness, and overall system configuration. These systems are not designed for instant vacuum and may require a significant amount of time to fully purge and reach maximum vacuum pressure. Please allow sufficient time for the system to reach the desired vacuum level before beginning operation.



Vacuum Chambers

Pressure and Vacuum Conversion Table

Gauge Vacuum (PSI)	Absolute Pressure (PSI)	Vacuum (In. Hg)	Vacuum (mbar)	Vacuum (kPa)	Absolute Pressure (Torr)	Gauge Vacuum (mm Hg)	Percent Vacuum (%)
0	14.7	0	0	0	760	0	0
0.49	14.24	1	33.9	3.4	735	25	3
0.98	13.75	2	67.7	6.8	709	51	7
1.47	13.26	3	101.6	10.2	684	76	10
1.96	12.76	4	135.4	13.5	658	102	13
2.45	12.27	5	169.3	16.9	633	127	17
2.95	11.78	6	203.2	20.3	608	152	20
3.44	11.29	7	237	23.7	582	178	23
3.93	10.8	8	270.9	27.1	557	203	26
4.42	10.31	9	304.7	30.5	531	229	30
4.91	9.82	10	338.6	33.9	506	254	33
5.4	9.33	11	372.5	37.2	481	279	36
5.89	8.84	12	406.3	40.6	455	305	40
6.38	8.35	13	440.2	44	430	330	43
6.87	7.86	14	474	47.4	404	356	46
7.36	7.36	15	507.9	50.8	379	381	50
7.86	6.87	16	541.8	54.2	354	406	53
8.35	6.38	17	575.6	57.6	328	432	56
8.84	5.89	18	609.5	60.9	303	457	59
9.33	5.4	19	643.3	64.3	277	483	63
9.82	4.91	20	677.2	67.7	252	508	66
10.31	4.42	21	711.1	71.1	227	533	69
10.8	3.93	22	744.9	74.5	201	559	73
11.29	3.44	23	778.8	77.9	176	584	76
11.78	2.95	24	812.6	81.3	150	610	79
12.27	2.45	25	846.5	84.7	125	635	83
12.76	1.96	26	880.4	88	100	660	86
13.26	1.47	27	914.2	91.4	74	686	89
13.75	0.98	28	948.1	94.8	49	711	92
14.24	0.49	29	981.9	98.2	23	737	96
14.7	0	29.92	1013	101.3	0	760	100



Additional Instructions For Acrylic Vacuum Chambers

Because acrylic is hygroscopic and can hold a small amount of moisture, applying vacuum to an acrylic chamber will draw moisture out of the walls of the chamber and cause a loss of vacuum pressure. If you require sustained vacuum over a long period of time, you may wish to leave the vacuum pump running with the vacuum valve open.

Alternatively, after applying vacuum for the first time:

- 1) Close the vacuum valve and wait approximately three hours for the vacuum level to stabilize.
- 2) When the vacuum level stops falling, turn the vacuum pump back on and reopen the valve.
- 3) After reapplying vacuum, the acrylic chamber will maintain the desired vacuum level over a much longer period (see chart below).

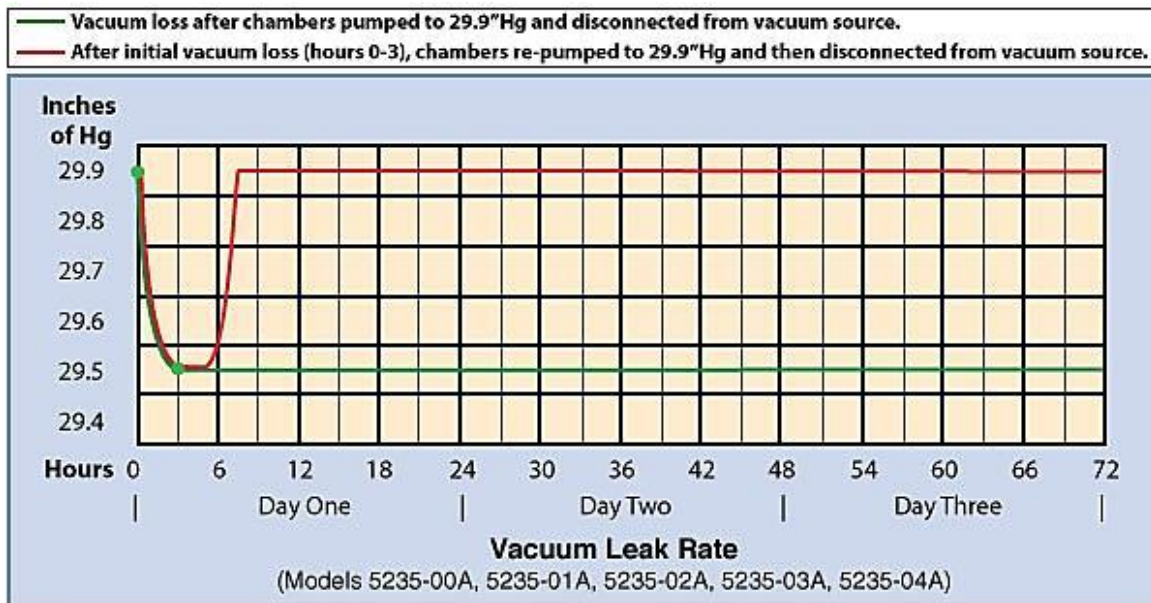


Figure 4. Tested leak-rate of an acrylic vacuum chamber showing the improved performance with reapplication of vacuum pump

3.3 Reducing Vacuum (Bleeding the Chamber)

- 1) Make sure the valve used to apply vacuum is closed.
- 2) If nitrogen or other process gas will be used to fill the chamber, connect the gas source to the second metering valve using $\frac{1}{4}$ " tubing.
- 3) Turn on the gas source.
- 4) While monitoring the vacuum gauge, slowly open the second valve to allow air (or process gas) to enter the chamber.
- 5) When the desired vacuum level is reached, close the valve.
- 6) Shut off the gas source and disconnect the tubing.



4. Maintenance

Terra's vacuum chambers require minimal maintenance other than periodic cleaning.



CAUTION

- Do not use isopropyl alcohol, chlorine bleach, ammonia-based cleaners, abrasives, organic solvents, or metal scouring pads when cleaning. Use a soft cloth all the time.
- Regularly check the vacuum seal as well as the surface where the body and the base are in contact – make sure they are always clean and undamaged.
- Regularly check the valves, vacuum gauge, and their vicinities for any blockage or damage.
- If the unit is contaminated, wear chemical-resistant gloves before cleaning.

Acrylic Vacuum Chambers

Acrylic may be cleaned with clean, lukewarm water with or without a mild, non-abrasive detergent and a dry, clean non-abrasive wipe. Use only light pressure when cleaning. If the outside surface is exceptionally dirty or gritty, lightly swab the surface with a saturated cloth and allow the surfactants to drain away. Avoid rubbing dirt or grit into the surface. Turn the cloth often and replace with a clean cloth frequently. Dry the surface by blotting gently with a clean, dry cloth.

Aluminum or Stainless Steel Vacuum Chambers



CAUTION

- Bleach will cause pitting on stainless steel surfaces.

Aluminum and stainless steel may be cleaned with isopropyl alcohol and the same cleaning techniques as an acrylic chamber (see above). For heavy duty cleaning agents or decontamination protocols, check chemical compatibility with the silicone gasket and other materials before use.



5. Specifications

Acrylic Vacuum Chambers	
Dimensions	See original order form
Seal Type	Nitrile rubber O-ring Standard Replacement: 5235-48 EPDM rubber on Acrylic Chamber 3305-80 EDPM Rubber Replacement: PA04158
Metering Valve	Nickel-plated, 1/4" tube connector
Vacuum Gauge	0 – 30"Hg
Wall Construction	1"-thick acrylic 1/2"-thick acrylic for 5235-08
Latch	Stainless steel, non-locking
Max Vacuum	29.9 inches Hg
Operating Temperature	5°C to 40°C

Aluminum Vacuum Chambers	
Dimensions	See original order form
Seal Type	Nitrile rubber O-ring Replacement: #PA02854
Metering Valve	Nickel-plated, 1/4" tube connector
Vacuum Gauge	0 – 30"Hg
Wall Construction	1/2"-thick aluminum, powder-coated 1"-thick aluminum for 1590-series part numbers
Latch	Stainless steel, non-locking
Viewing Window	1"-thick acrylic
Max Vacuum	29.9 inches Hg
Operating Temperature	5°C to 40°C

Stainless Steel Vacuum Chambers	
Dimensions	See original order form
Seal Type	Silicone, heat-resistant
Metering Valve	Nickel-plated, 1/4" tube connector
Vacuum Gauge	0 – 30"Hg
Wall Construction	304-grade stainless steel, double-wall
Latch	Electropolished stainless steel LiftLatch, non-locking
Viewing Window	1/2"-thick tempered safety glass
Max Vacuum	29.9 inches Hg
Operating Temperature	5°C to 40°C



6. Warranty

Products Manufactured by Terra: Terra Universal, Inc., warrants products that it manufactures to be free from defects for a period of 12 months for parts and 90 days for labor, commencing from the date of shipment. This limited warranty covers parts and labor, but not transportation and insurance charges. Terra's sole responsibility is to repair or replace, at its option, any part of the product that proves defective or malfunctioning during this time limit. In some cases, components incorporated in Terra Universal products are covered by additional warranties from component manufacturers; obtain specific information from Terra sales representatives. Repairs may be completed by 3rd party service agents approved by Terra Universal. Terra Universal reserves the rights to limit this warranty based on a service agent's travel, working hours, the site's entry restrictions and unobstructed access to serviceable components of the product. This warranty is void if the equipment is abused or modified by the customer, is operated outside Terra's operating instructions or specifications, or is used in any application other than that for which it is specified. This warranty does not include routine maintenance or service procedures, shipping damage, nor damage from misuse, intentional or unintentional abuse, neglect, natural disasters, or acts of God.

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Freight Shortage or Damage: Upon receipt of any equipment from Terra Universal, Inc., customer shall immediately unpack and inspect for damage or shortage. The customer shall not accept a damaged package or a short shipment until the carrier makes a "damage or shortage" notation on both the carrier's and customer's copy of the freight bill or delivery receipt. Service title passes when the shipment is loaded, so customer is responsible for filing and collecting a freight claim. Any replacement products must be ordered and paid for separately. For Terra's "Policy and Procedures for Returning Goods," see Terra's Internet site: www.TerraUniversal.com.

Generally, customers can improve the chance of collecting on a freight claim by following these procedures: 1) formally requesting that the carrier inspect the shipment immediately upon suspecting damage or shortage to verify condition; 2) notifying the carrier upon discovery of concealed damage and requesting an inspection within 15 days of receipt, both in person or phone and following up via mail; 3) keeping the shipment as intact as possible, including retaining original packaging materials and keeping the product as close to the original receiving location as possible; 4) holding salvage for disposition by the carrier.

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Warranty Returns: All warranty returns must be authorized in advance by Terra Universal and approved under an RMA. Unless approved in advance for good reason, all returns must be in original condition, including all manuals, and must be packaged in original packaging materials. All returned goods are to be shipped to Terra Universal, freight prepaid at customer's expense. See Terra's "Policy and Procedure for Returned Goods."

*Thank you for ordering from
Terra Universal!*