PUMPKIN™
SPACE SYSTEMS
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DVC1

Hardware Revision: B

Desktop Vacuum Chamber

Applications

- R & D
- Education
- Production
- Prototyping
- Test & Validation

Features

- Pumps down rapidly
- Provides rapid access to device under test
- Small size yields economical operation
- Utilizes standard glass bell jar as cover
- Monolithic base available in a variety of materials for tailored applications:
  - Bare Aluminum
  - Hard-anodized Aluminum
  - Ultra-High Molecular Weight Polyethylene (UHMW PE)
  - Stainless Steel
- Four access ports for vacuum, fluid, electrical and other feedthroughs
- One ISO-K 63 flange for turbopump mounting
- Large interior volume to accommodates device under test, plus sensors, wiring and cabling, thermal components, etc.
- Modular feedthrough panel architecture
- Suitable for roughing and HV applications
- Portable, with small footprint
- Standard sizes of sealing O-rings simplify maintenance
- Integral support for securing base to inch- and metric-pattern optical tables
- Open architecture – end-users can create their own feedthrough panels for each access port
- Affordable

711-00654 shown with optional equipment

ORDERING INFORMATION

Pumpkin P/N	Configuration
711-00652	Natural Aluminum Base
711-00653	Hard-anodized Aluminum Base
711-00654	UHMW PE Base
711-00655	Stainless Steel Base

Option Code	Configuration
/00 (standard)	Supplied with EPDM O-rings
/01	Supplied with Viton® O-rings

Contact factory for availability of optional configurations.

CHANGELOG

Rev.	Date	Author	Comments
i	20100725	AEK	Initial release (internal).
A	20100804	AEK	Additional material, drawings, picture.
B	20100831	AEK	Changed some nomenclature.
C	20120123	AEK	Changed some nomenclature (again). Added turbopump interface specifications.

OPERATIONAL DESCRIPTION

Pumpkin's Desktop Vacuum Chamber DVC1 incorporates many user-friendly features for enhanced versatility and performance over large and expensive traditional chambers. Its split-volume design can enclose not only a device under test, but also the cold plates, thermocouples, electrical umbilicals, etc. associated with operation under vacuum and/or thermal test conditions.[1] The size-optimized volume permits rapid purging and evacuation of the chamber. The DVC1 use standard-size O-rings to help minimize operating costs. The clear glass bell jar cover permits a full 360-degree visible evaluation of the device under test, and offers RF transparency. The base is available in a variety of materials for different applications.

For the outgassing and adsorption concerns of HVAC applications, the materials that form the chamber's interior are limited to:

- Bell jar cover: Glass
- Base: Aluminum (hard-anodized or natural), UHMW PE, or Stainless Steel
- O-rings: EPDM, fluorocarbon / Viton® or other user-provided materials
- Access ports: Dependent on panel material(s)

The Aluminum and Stainless Steel versions of the DVC1 base can be baked to remove residual water, etc. for applications requiring vacuum levels beyond 1 x 10^{-3} Torr.

Each DVC1 base has four identical rectangular access ports, to which feedthrough panels are attached. Each feedthrough panel is sealed to the base with a single O-ring and is secured to the base with twelve machine screws.[2] Available feedthrough panels include sealing (blank), vacuum/fluid feedthrough and electrical feedthrough panels. Additionally, end-users can create their own feedthrough panels for specialized applications (e.g., for RF connectors or custom cold plates). For vacuum connections, the geometry of the side access ports permits two industry-standard DN16KF-size vacuum fittings, sealing O-rings and clamps per port. An ISO-63-size turbopump port is provided at the bottom center of the base. For fluid connections, the geometry of the access ports supports two industry-standard ¼" NPTF and similar fittings per port. For electrical connections, the access ports are sufficiently large to accommodate a variety of signals per port.

Each DVC1 base is made from a single piece of monolithic material. As a result, the DVC1 base is stable and strong. No welds or other joining methods are used. Removable external rubber isolators are provided with each base.

Picture 1: MISC 2 nanosatellite resting inside DVC1. The MISC 2 is on a Support Plate (716-00677) that permits offset placement within the DVC1, and leaves 2" (50mm) of room beneath it for cabling, etc. An Electrical Feedthrough Panel Kit (716-00681) is mounted on one of four access ports.

USE WITH CUBESATS

The glass bell jar cover is large enough to fully encompass a complete 3U-size CubeSat[3] nanosatellite, with deployable panels in their stowed position. The additional volume within the base eases access into the vacuum chamber through the access ports, provides a location for wiring and fluid lines within the chamber, and enables items like cold plates to be located within the chamber in close proximity to the satellite under test.

[1] Cold plates, test equipment, and other items are to be provided by the end-user and are not included.
[2] Receiving threads in the base are implemented in a variety of ways, depending on the base material.
[3] The CubeSat Design Specification (CDS) is maintained at http://www.calpoly.org/.

ABSOLUTE MAXIMUM RATINGS

Parameter	Conditions / Notes	Symbol	Value	Units
Operating temperature	EPDM O-rings, Al base, SS feedthroughs	T_{A_EPDM}	-55 to +150	ºC
	Viton® O-rings, Al base, SS feedthroughs	T_{A_VITON}	-25 to +200	ºC

MATERIALS & CONSTRUCTION

Parameter	Conditions / Notes	Value
Bell jar cover		Flint glass
Base	Natural Aluminum	Aluminum 6061-T6
	Hard-anodized Aluminum	Aluminum 6061-T6, hard anodized (MIL-A-8625F Type III, Class I)[4, 5]
	UHMW PE	UHMW PE[6]
	Stainless Steel	316 SST
Feedthrough panels	Blank (sealing)	Aluminum 6061-T6
	Vacuum/fluid (feedthrough)	316 SST, passivated
	Electrical	FR-406, Copper-clad, Immersion Gold finish
O-rings		EPDM or Viton®

[4] Base is hard-anodized except for underside, which is plated with a clear alodyne (i.e., conductive) finish. This provides a conductive path to the entire base via its underside, e.g. for mounting on a conductive optical table surface.

[5] Clear hard anodizing, followed by sealing via deionized water (DI).

[6] The UHMW PE version utilizes a copper-clad, immersion gold-plated PCB on its underside to provide a low-impedance ground plane to attached feedthrough panels.

PHYSICAL CHARACTERISTICS[7]

Parameter	Conditions / Notes	Min	Typ	Max	Units
O-ring length	All six O-rings. Does not include other, external fittings		208		cm
Interior surface area	Base and bell jar cover.		4000		cm^2
Interior volume	Enclosed by base and bell jar cover. Does not include port volumes.		16		cm^3
Width	Base[8]		300	301	mm
Depth			300	301	mm
Height	Base + bell jar cover		525	550	mm
	Internal[9]			445	mm
Width	Feedthrough port[10]		102		mm
Height			35		mm
Base bolt square pattern[11]	4x M6 x 70mm SHCS		250.0		mm
	4x ¼"-20 x 2 ¾" SHCS		10.00		inch
	4x 3/8"-16 x 2 ¾" SHCS		9.921		inch
Turbopump port	Diameter		70		mm
Turbopump interface bolt circle pattern	4 x M8, compatible with DN 63 ISO-F and DN 63 ISO-K flanges		110		mm
Mass	Aluminum base only		8.1		kg
	UHMW PE base only		2.8		kg
	Stainless Steel base only		24		kg
	Bell jar cover		7.5		kg
	Complete assembly (Aluminum base) with four fluid feedthrough panels		19		kg

CONSUMABLE COMPONENTS

Parameter	Conditions / Notes	Specification
Bell jar cover O-ring	One per base	ASA586A Dash Number 176
Access port O-ring	One per access port	ASA586A Dash Number 153
Turbopump O-ring	One per turbopump	For sealing ISO63 flanges

PERFORMANCE

Parameter	Final Vacuum	Conditions / Notes	Min	Typ	Max	Units
Pumpdown time[12]	1×10^{-5} Torr	50l/s turbopump backed by $16 m^3/h$ roughing pump. Minimal bakeout.		60		s
	4×10^{-6} Torr			8		hr

[7] Not including removable rubber isolators that are normally attached to the base in portable applications. Each rubber isolator measures approximately 55mm in diameter, 20mm in height, and weighs 50g.

[8] Base's footprint is larger than base circle of bell jar cover.

[9] Measured axially.

[10] Access port corners are radiused at 7mm.

[11] For mounting the base to optical or other tables, etc.

[12] For bare aluminum base.

SIMPLIFIED MECHANICAL LAYOUT [13]

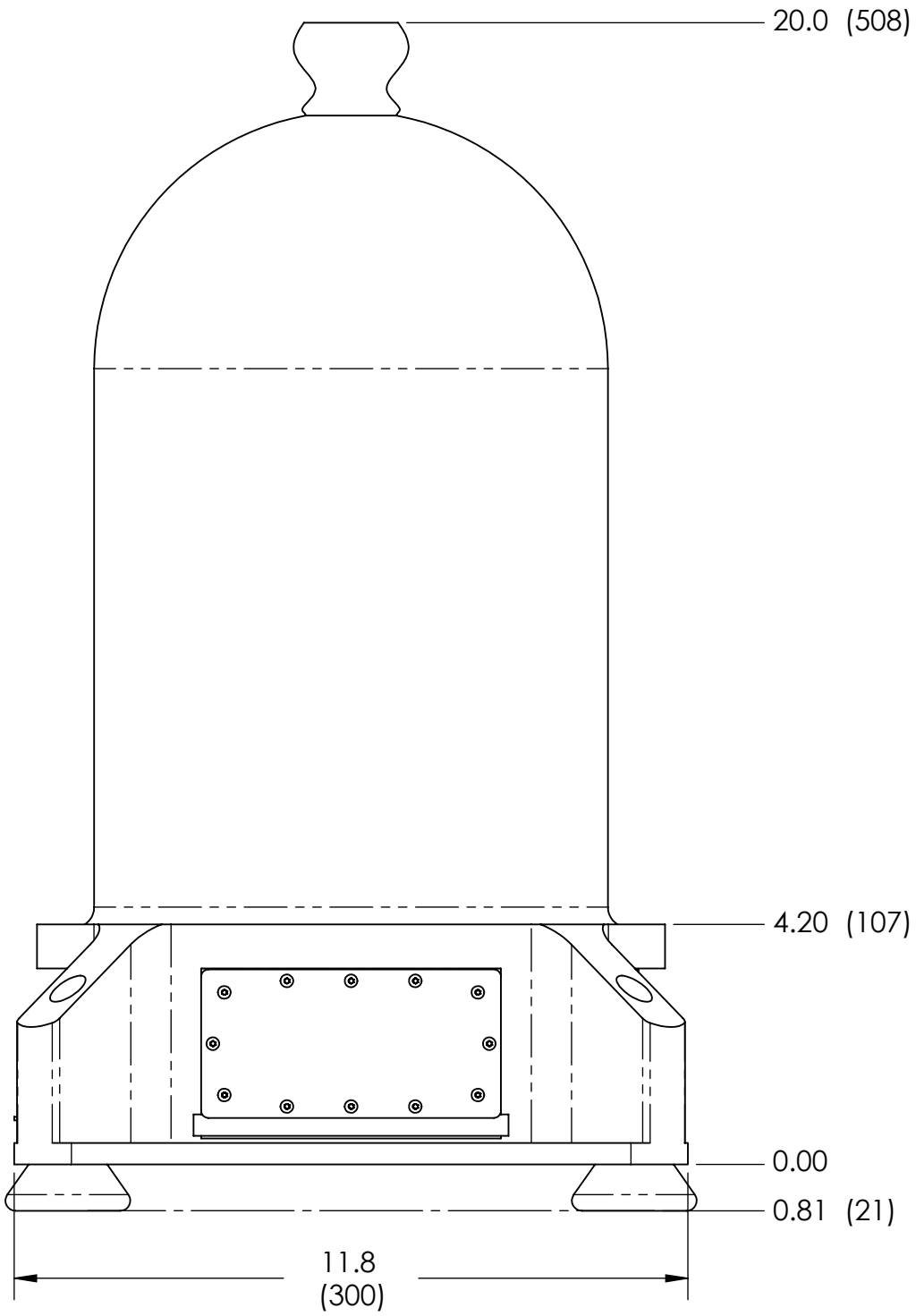

Figure 1: Overall dimensions, front view. Shown with isolator feet attached.

[13] Dimensions in inches (mm).

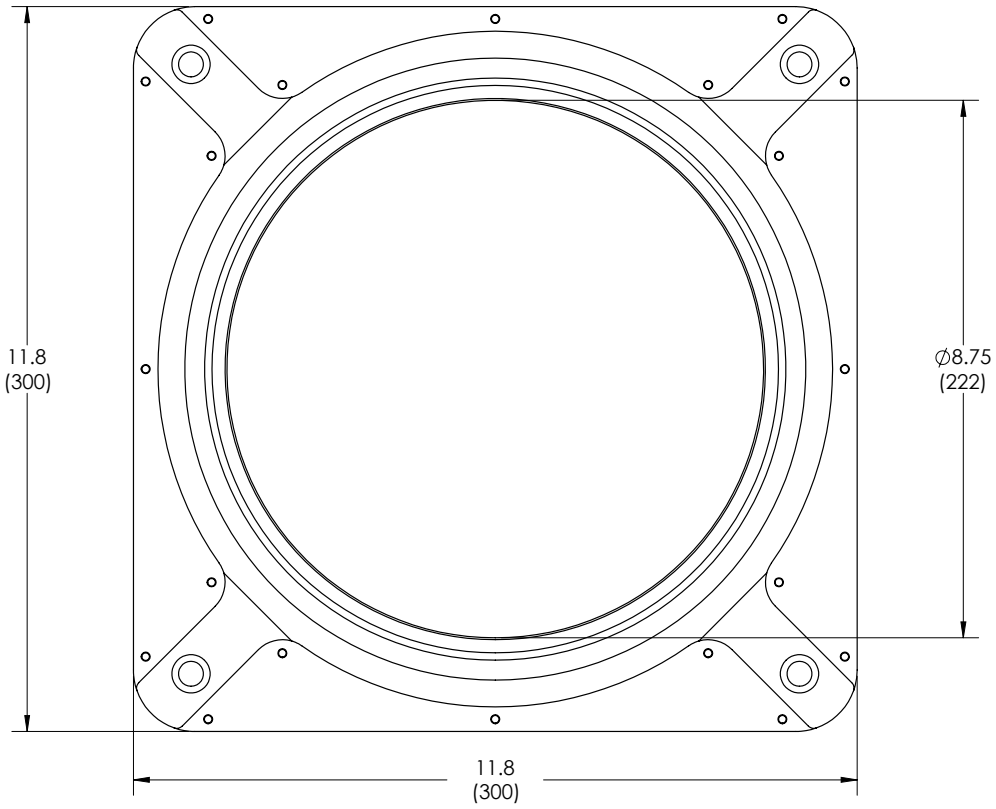

Figure 2: Overall dimensions, footprint. Shown without isolator feet. Turbopump inlet port not shown.

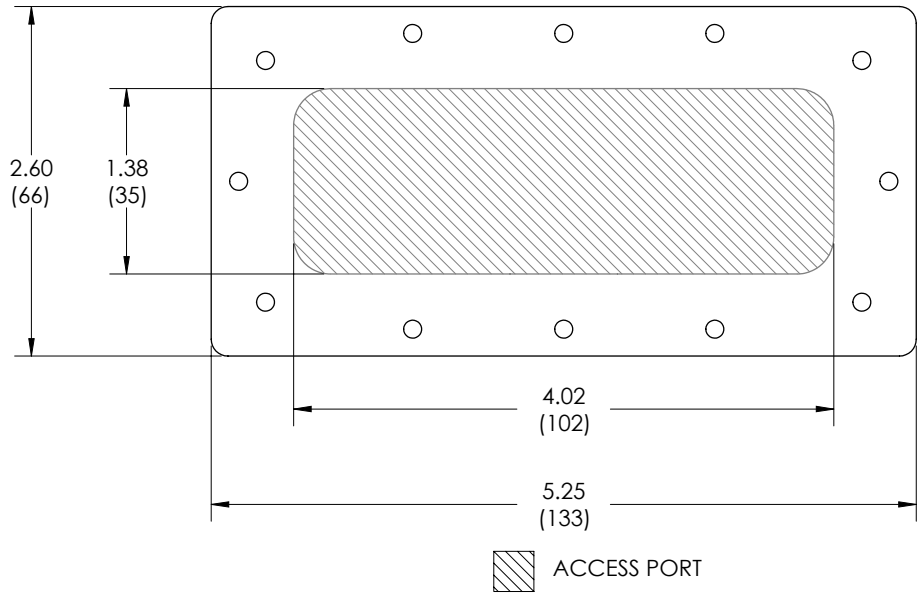

Figure 3: Access port dimensions. O-ring lies between shaded area and bolt holes.

AVAILABLE FEEDTHROUGH PANELS

A variety of feedthrough panels are available for different applications,[14] as listed below:

Description	Conditions / Notes	Pumpkin P/N
Sealing panel (blank)	Aluminum	716-00678
Fluid panel	Stainless Steel, with two ¼" NPTF ports	716-00679
Fluid panel (blank)	Stainless Steel, blank, for customization by the end-user	716-00680
Electrical panel	Copper-clad immersion gold-finished FR-406, with: • one 10-BaseT RJ45 Ethernet connector • three USB 2.0[15] type B connectors • eight high-power screw terminal connectors • fifteen pairs of low-power signal connectors	716-00681

Refer to the individual Pumpkin datasheets for more information on each panel.

DIRECTIONS FOR USE

For more information on using the Desktop Thermal Vacuum Chamber, please see the User Manual.

[14] Each feedthrough panel is supplied with the panel-specific fasteners and other hardware required to mount it to the DVC1 base.
[15] Low-speed and full-speed operation are supported.

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