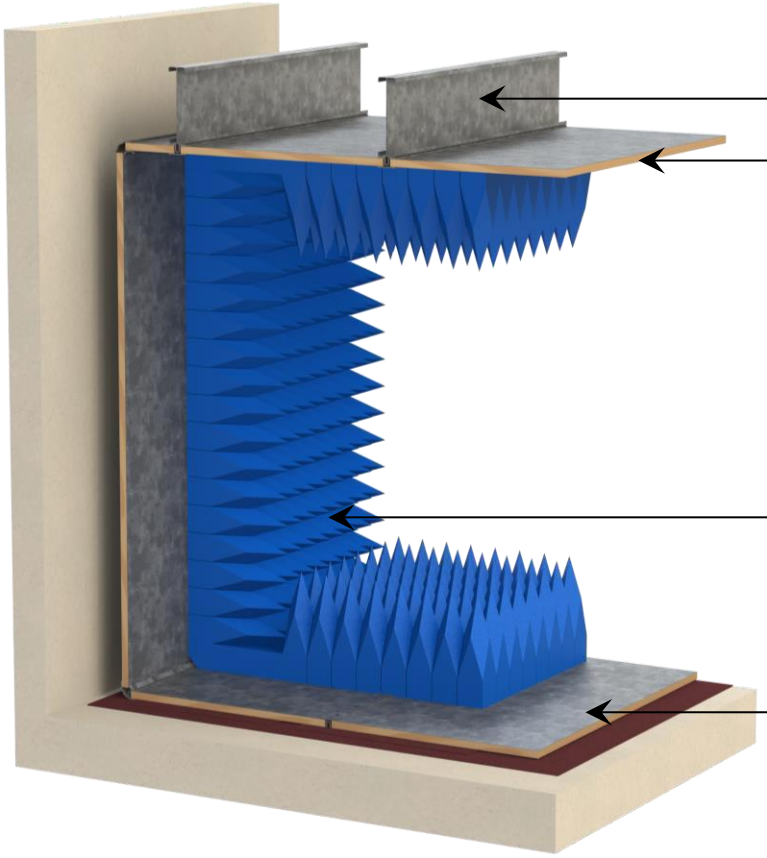
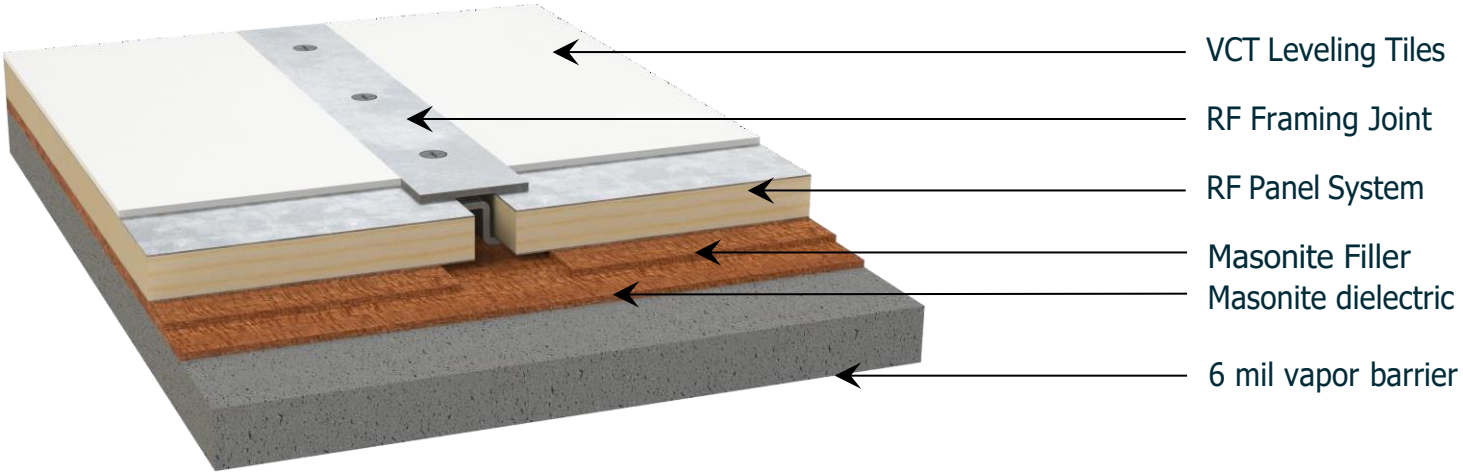
HIGH-SPEC RF SHIELDING

RF GALVANIZED PANEL SYSTEM

The modular structure is traditionally used for high performance shielding. Panels are galvanized sheet steel bonded to a wood core that are attached via framing joints. The RF panel system is typically supported via threaded rod and dielectric isolators attached to the deck above or can be self-supported using C-joists. The RF galvanized flooring system consists of galvanized steel panels installed over a 6 mil vapor barrier and layers on Masonite (used as an isolator and filler between the framing channels). The top of the RF panel is then filled with VCT leveling tiles flushing the floor with the profile of the framing channels; providing a sub-surface ready to accept finish flooring by others.



Load Distribution
>10 psf (without absorbers)



65-6 CHAMBER

The high-spec modular structure is traditionally used for high performance shielding. Panels are galvanized sheet steel bonded to a wood core that are attached via framing joints. The RF panel system is typically self-supported via Unistrut so no attachment to a parent wall or to a slab above is required.

SHIELDING PERFORMANCE

Plane Wave: >100dB from 50MHz to 18GHz

LEGEND – Component Type:

1. RF Panel System (6-sided enclosure)
2. RF Labyrinth Door (Pg. 6)
3. Unistrut Support System
4. RF Waveguide (Pg. 7)
5. RF Power Filter (Pg. 8)

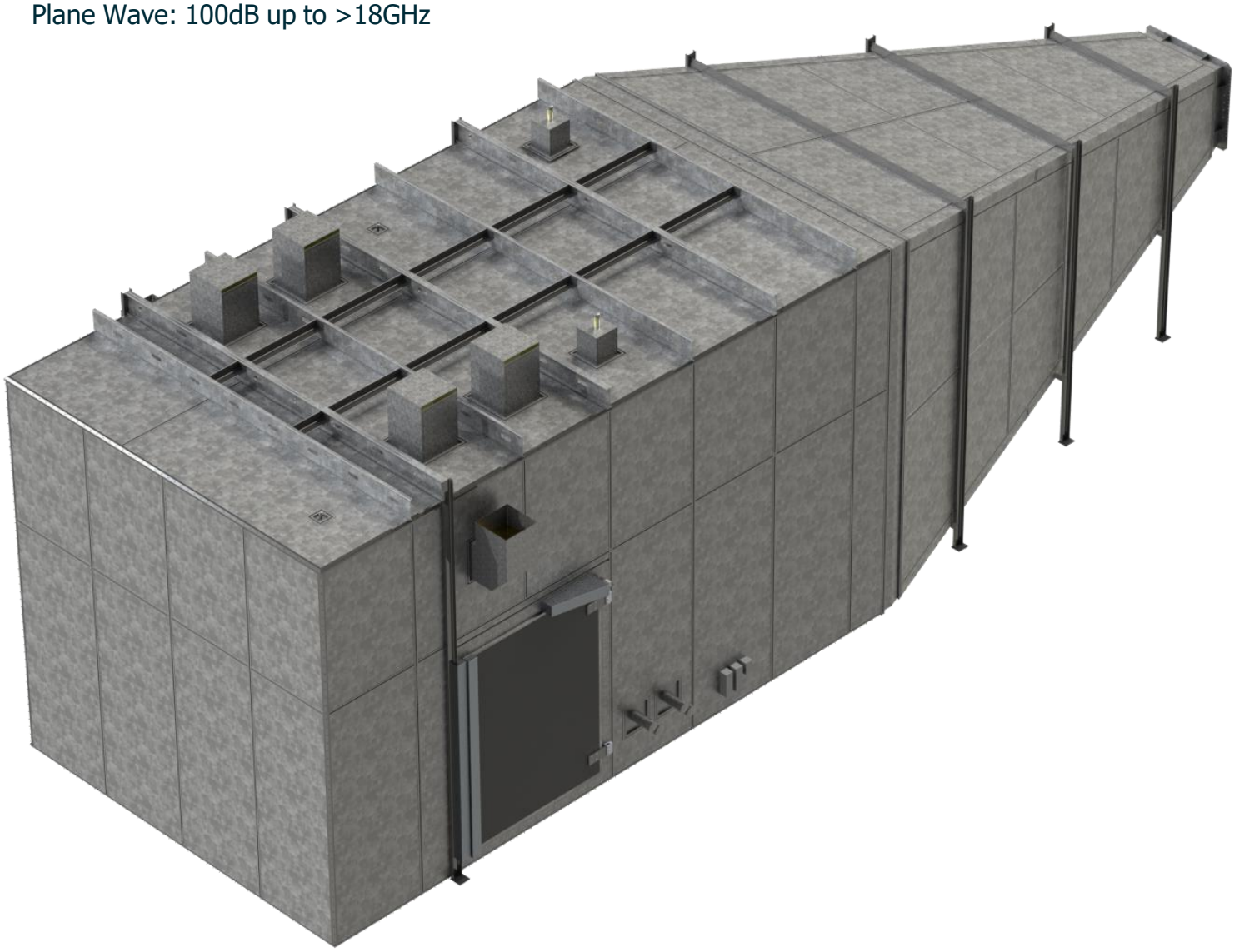
ANECHOIC/TAPERED CHAMBER

A function of RF construction is to create a noise free environment to retain RF signals inside of the shielded environment. To complete the RF shielded environment, all accessories and facilities associated with the enclosure will meet or exceed the minimum functional requirements (as listed below). This includes but is not limited to the entire six-sided RF enclosure, the RF door, waveguides for HVAC and/or piping, and RF filters for electrical.

The Tapered Chamber creates a noise free environment to allow for performance of VHF/UHF measurements. They work extremely well for high-specification requirements.

SHIELDING PERFORMANCE

Plane Wave: 100dB up to >18GHz



MOBILE CABINETS

Our custom, turn-key RF Cabinets are used to test smaller pieces of equipment and can achieve remarkable shielding attenuation. Cabinets can be designed to any size and will include at least one state-of-the-art, high-spec labyrinth door (page 7). Enclosure penetrations can also be customized to suit the customers' needs and requirements.

SHIELDING PERFORMANCE

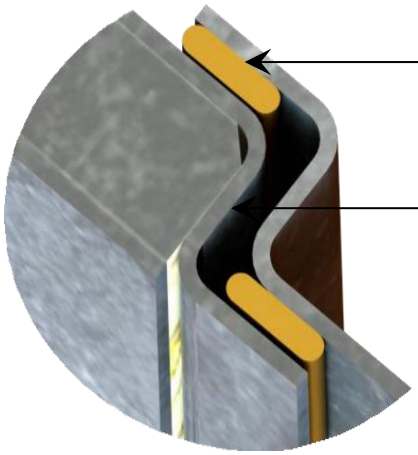
Plane Wave: 100dB up to >18GHz

HIGH-SPEC LABYRINTH DOOR

Our State-of-the-Art, High-Spec Labyrinth door is designed for industrial environments. The door leaf and frame are made from heavy duty galvanized steel. Notable features include Fabric-Over-Foam gaskets and our custom labyrinth contact surface which provides a durable and reliable door with minimal maintenance.

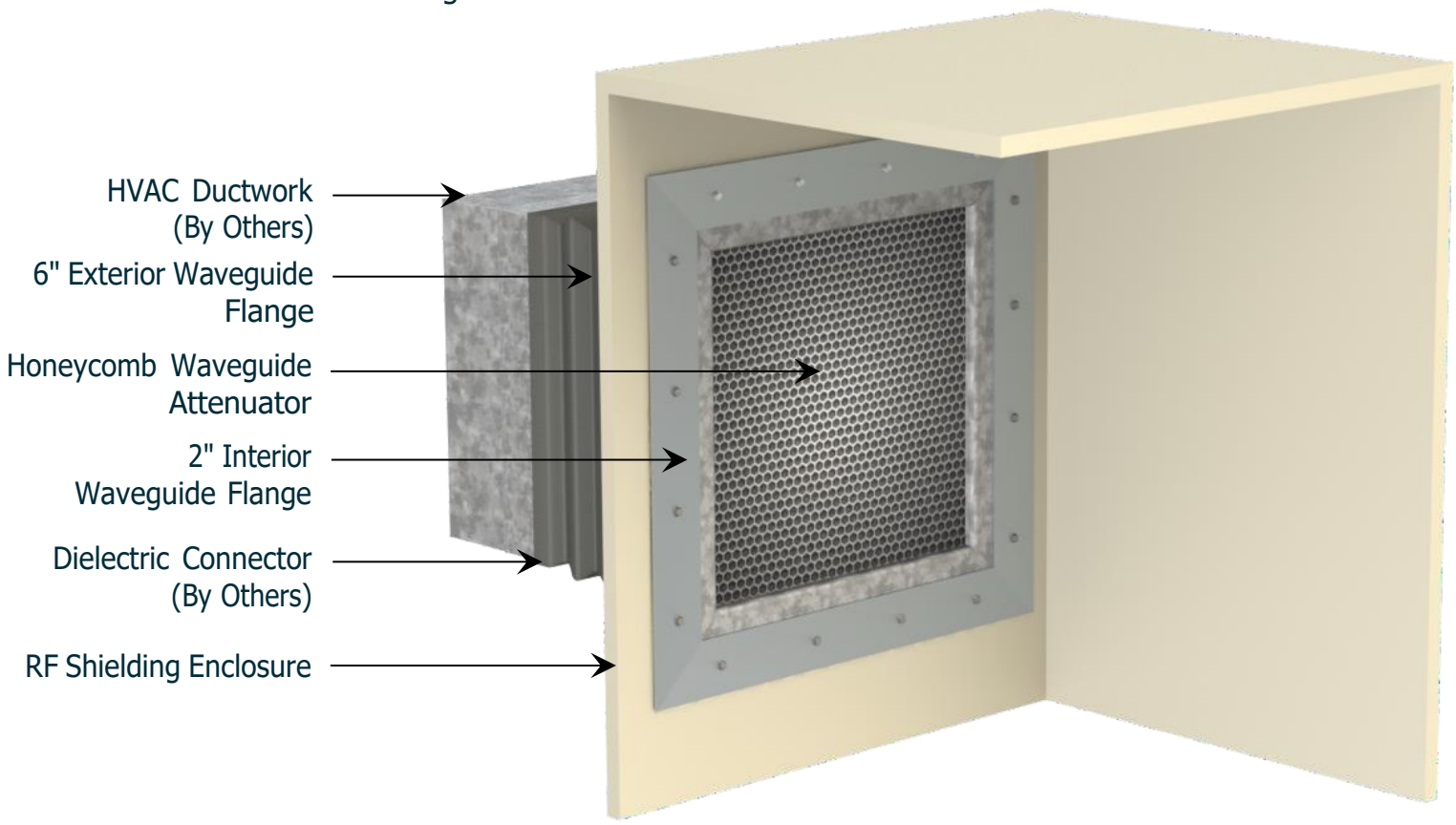
- Fingerless (RF Gasket to be used in lieu of fingerstock).
- Step-over sill design.

Shielding Effectiveness
Tested up to 100dB @ 18GHz



HIGH-SPEC WAVEGUIDE VENTS

All HVAC access points into the shielded enclosure will need to be treated with a hex cell honeycomb waveguide vent assembly. In high specification environments, the waveguides for these systems are manufactured to meet attenuation requirements of the enclosure. A labyrinth assembly may be required at the outside for added shielding effectiveness.



HONEYCOMB CELL [3/16" or 1/8"] x 1" THICK

INSIDE ENCLOSURE

Shielding Effectiveness

Hex Cell Size	Magnetic		Electric		Planewave		Microwave		
	1kHz	20kHz	100kHz	10MHz	100MHz	1GHz	10GHz	18GHz	40GHz
3/16"	25dB	120dB	120dB	120dB	120dB	120dB	120dB	120dB	N/A
1/8"	25dB	120dB	120dB	120dB	120dB	120dB	120dB	120dB	100dB

Pressure Drop

Inches of Water (3/16")	0.015	0.025	0.042	0.065
Inches of Water (1/8")	0.025	0.035	0.045	0.060
At Feet Per Minute *	400	600	800	1,000

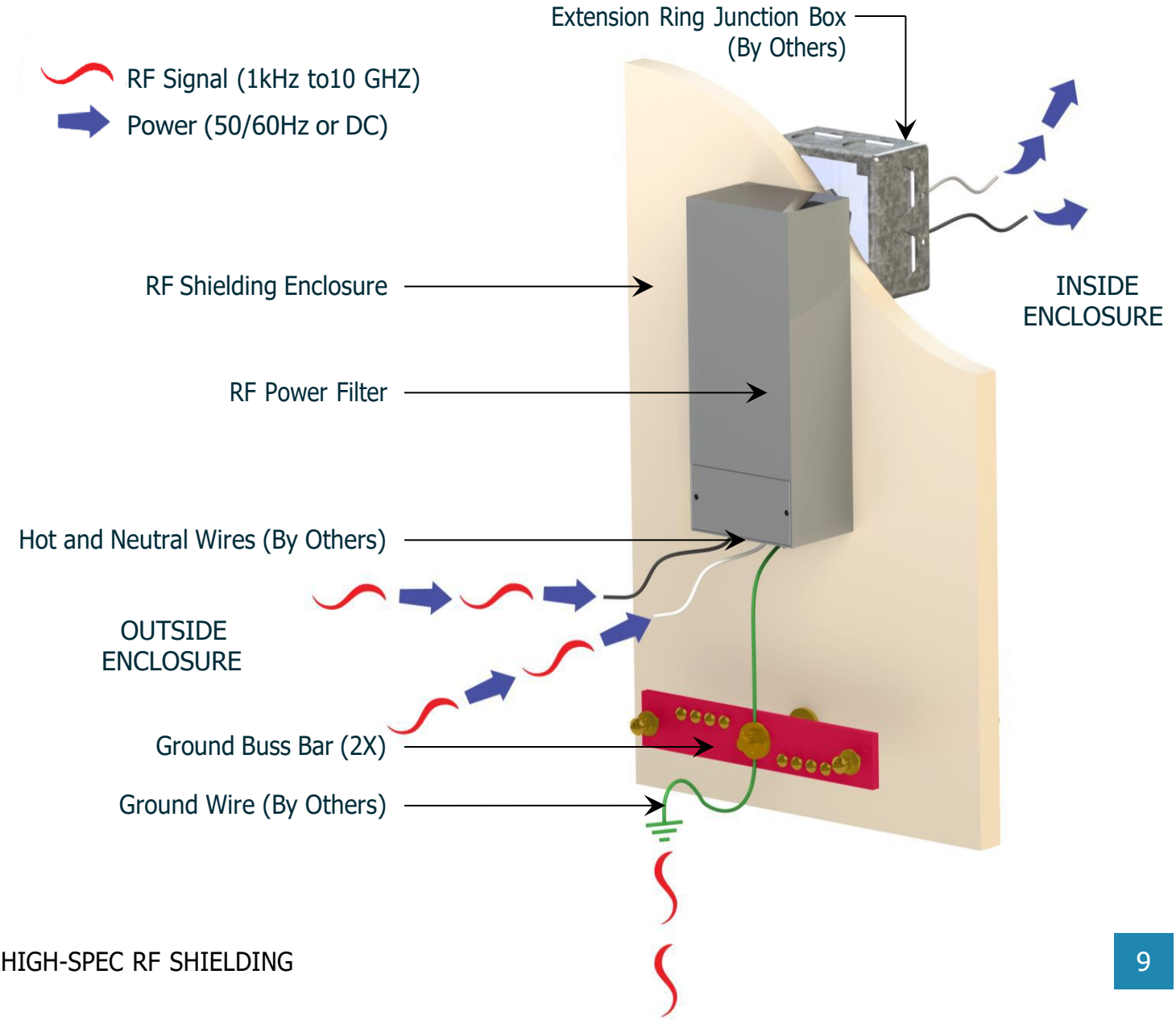
* Multiply by area to obtain CFM

RF POWER FILTERS

Power and communication line filters are fundamental elements of the RF enclosure. Filters are needed to assure unwanted electrical interference and or signals from entering the RF shielded enclosure.

The RF attenuation of our filters is consistent with the specified attenuation performance of the RF enclosure. The minimum attenuation of the RF Filter when performed per the methods of MIL-STD-220 are > +/- 100db from 100 kHz through 18 GHz.

Each filter housing is provided with an integral pipe penetration which penetrates through the enclosure carrying the clean filtered power to the interior of the enclosure. The filter housing is hermetically sealed to integrate seamlessly into the enclosure. The input (dirty) terminal are typically threaded extension with hardware. The output (clean) terminal are 3 feet long lead through the pipe penetration.

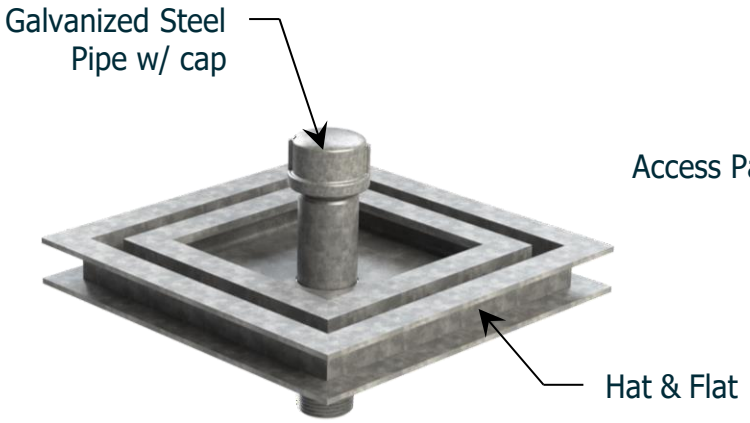


OTHER HIGH-SPEC PENETRATIONS

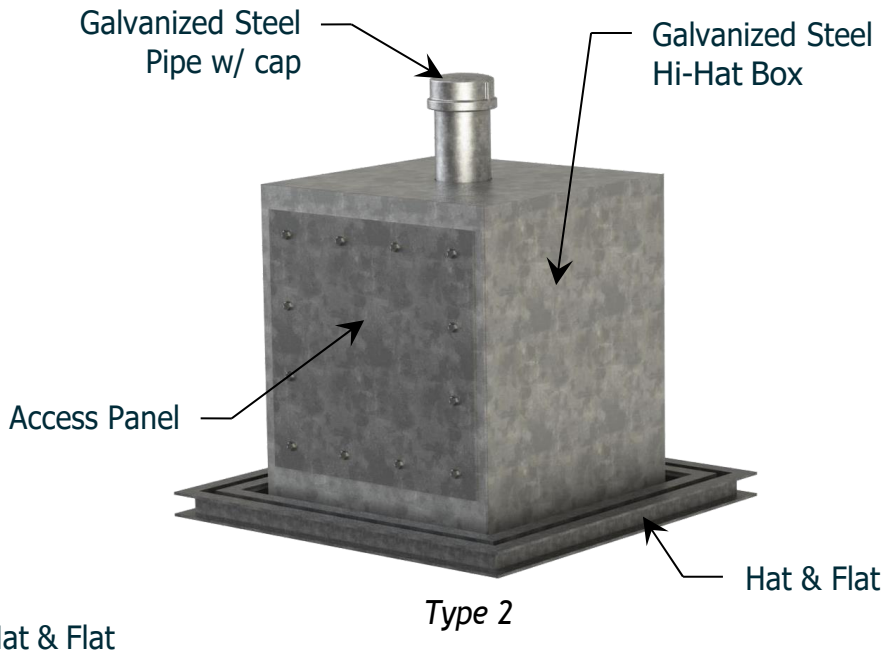
These high-spec penetrations are typically used in anechoic and tapered chambers. These penetrations allow for the installation of sniffer systems, LED lights, sprinkler systems, etc. to be installed within these types of enclosures. Pipe penetrations will include caps during testing only prior to the installation of the equipment penetrating the shielding.

LEGEND – Penetration Type:

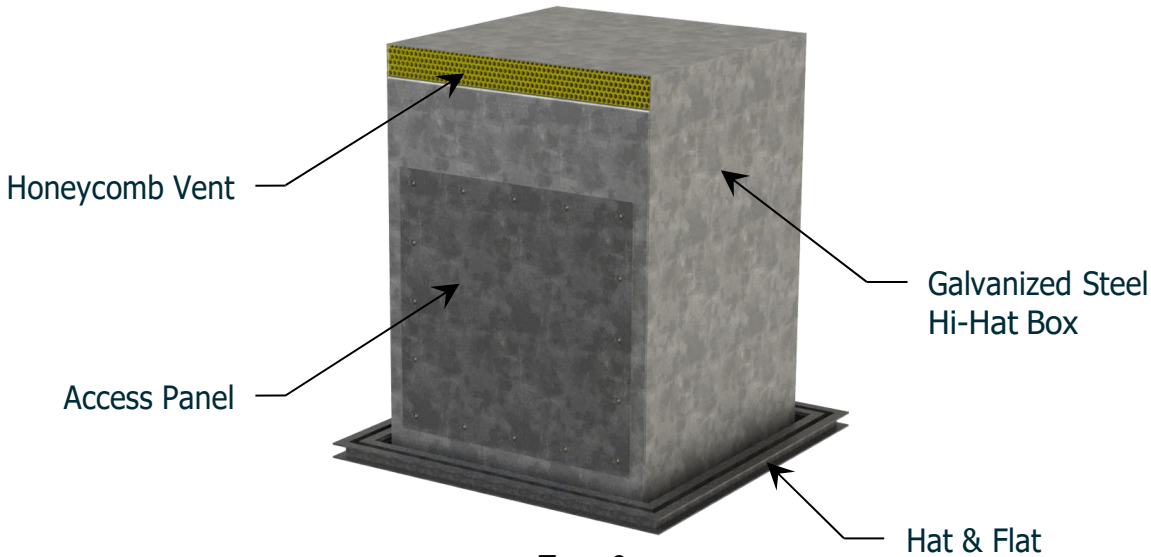
1. VESDA Penetration
2. Nozzle Box
3. High-Hat for LED Light Fixture



Type 1



Type 2



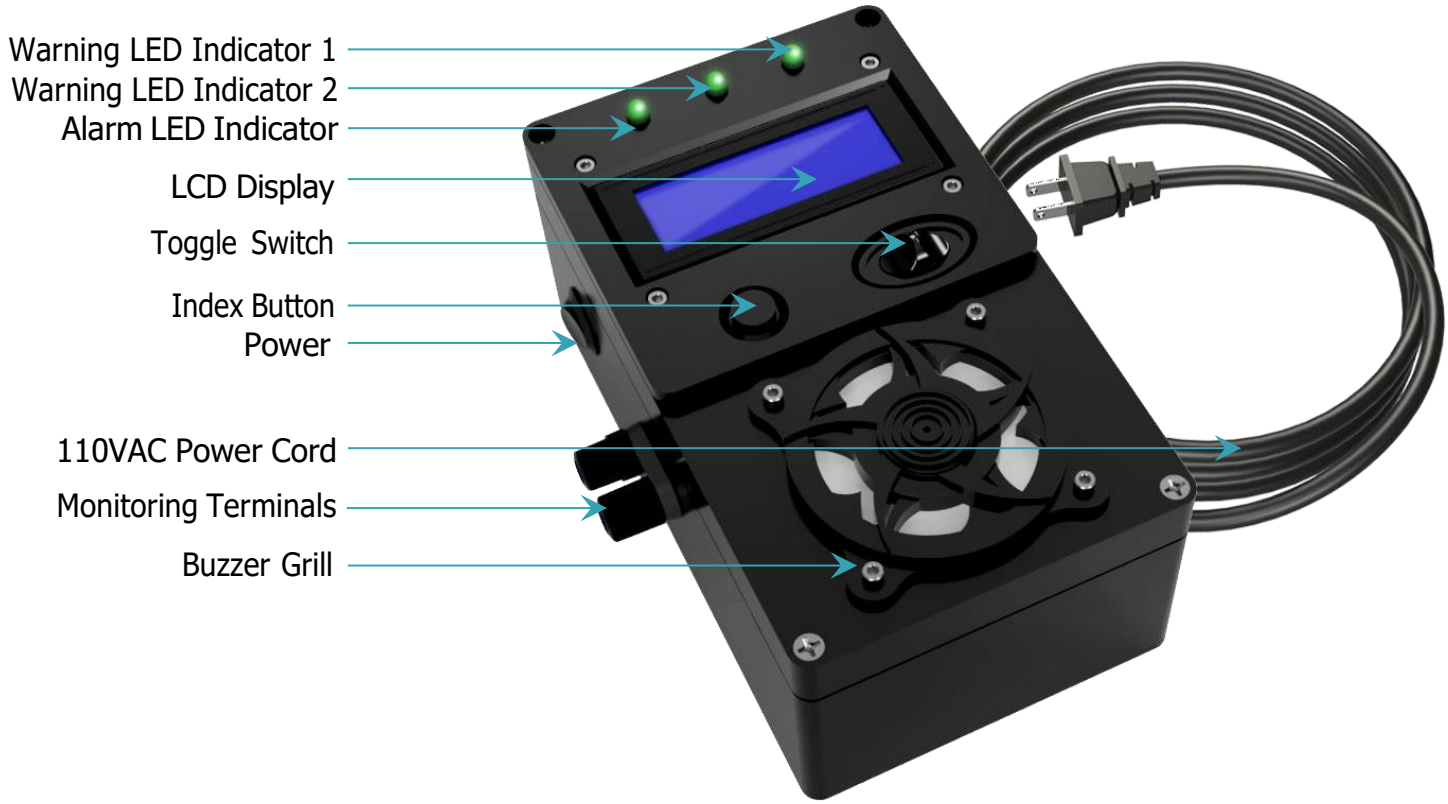
Type 3

GROUND MONITORING MODULE

Most, if not all, RF enclosures have a strict requirement for a single point ground. To achieve this, the enclosure is isolated (floating) from the building ground throughout the construction process and grounded to the building at the conclusion of the project. When the room is under construction a ground alarm is connected to the enclosure to monitor the isolation.

GROUND MONITORIZING MODULE BENEFITS:

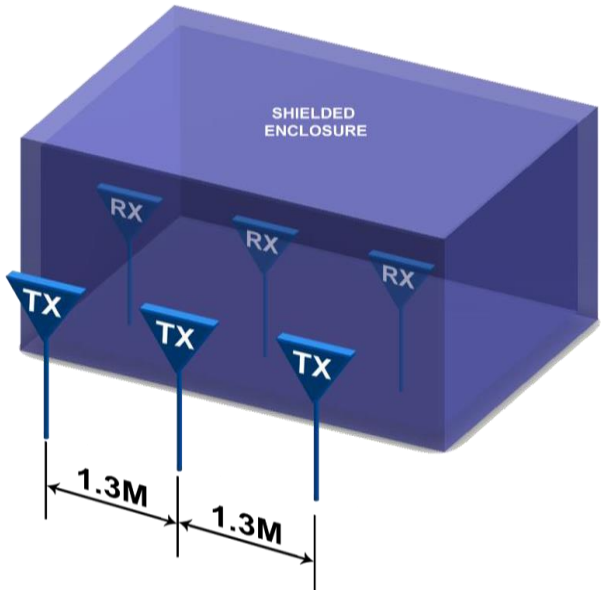
- Utilizes standard 110VAC power eliminating the need for battery replacement throughout the project. The batteries used for battery operated ground monitors die and need to be replaced frequently. Once the batteries die, there is no indication if/when the room is grounded.
- Built-in "Ground Time Stamp" which indicates the date and time a room is grounded. Owners and contractors will know exactly who was in the room at the time the room was grounded and what may have been done to ground the room.
- Smart technology indicating ground at 1k ohms, and two warning stages at 10k ohms and at 5k ohms. This proves useful during the construction phase because the shield can be monitored in real time and addressed before it becomes critical.
- Provided at no additional cost with each enclosure.



CERTIFICATION PROCESS

To obtain the optimal performance within a high-spec enclosure, the equipment needs minimal RF noise in the surrounding environment. The RF noise is frequencies of radio and magnetic waves which are measured in Decibel (dB) units. The critical frequency range for each enclosure will vary as noted per the enclosure type. To determine the Shielding Effectiveness (SE) a series of tests are performed at different locations throughout the enclosure. These tests utilize specialized equipment to transmit and receive RF noise at a specified frequency in accordance to set of standards required. The test starts by placing a Transmit Antenna (TX) outside the enclosure that transmits a specified amount of RF noise (dB) at a specific frequency. The technician then takes the Receive Antenna (RX) inside the enclosure and closes the door. The Shielding Effectiveness (SE) is determined by the difference in dB once the door is closed. This difference in value is typically referred to as the shielding attenuation.

TEST PLAN



1. Room will be tested up to the maximum required specification for the specified shield type.
2. Each wall of the RF shielded room that is accessible for the measurement will be tested. For areas that are inaccessible for the direct location of the transmitting antenna, the inside of that area will still be scanned using the receiving antenna with the transmitting antenna positioned as close as possible to the intended test position, that position will be noted on the test data table.
3. Each accessible plane of the wall is subdivided so that the horizontal spacing is no more than 1.3 m (4 ft 3 in.) for the TX and RX horizontal positions.
4. Measurements are taken with a vertical antenna polarization. Both TX and RX antennas will be aligned with the same polarization.
5. For localized testing of shielded room items such as doors, windows, filters, penetration areas, etc. the transmitting antenna (as well as receiving antenna) will be positioned in front of the items that is being test.
6. Provide Certified Report.