

MarShield™

CUSTOM RADIATION SHIELDING PRODUCTS



MRI / RF SHIELDING

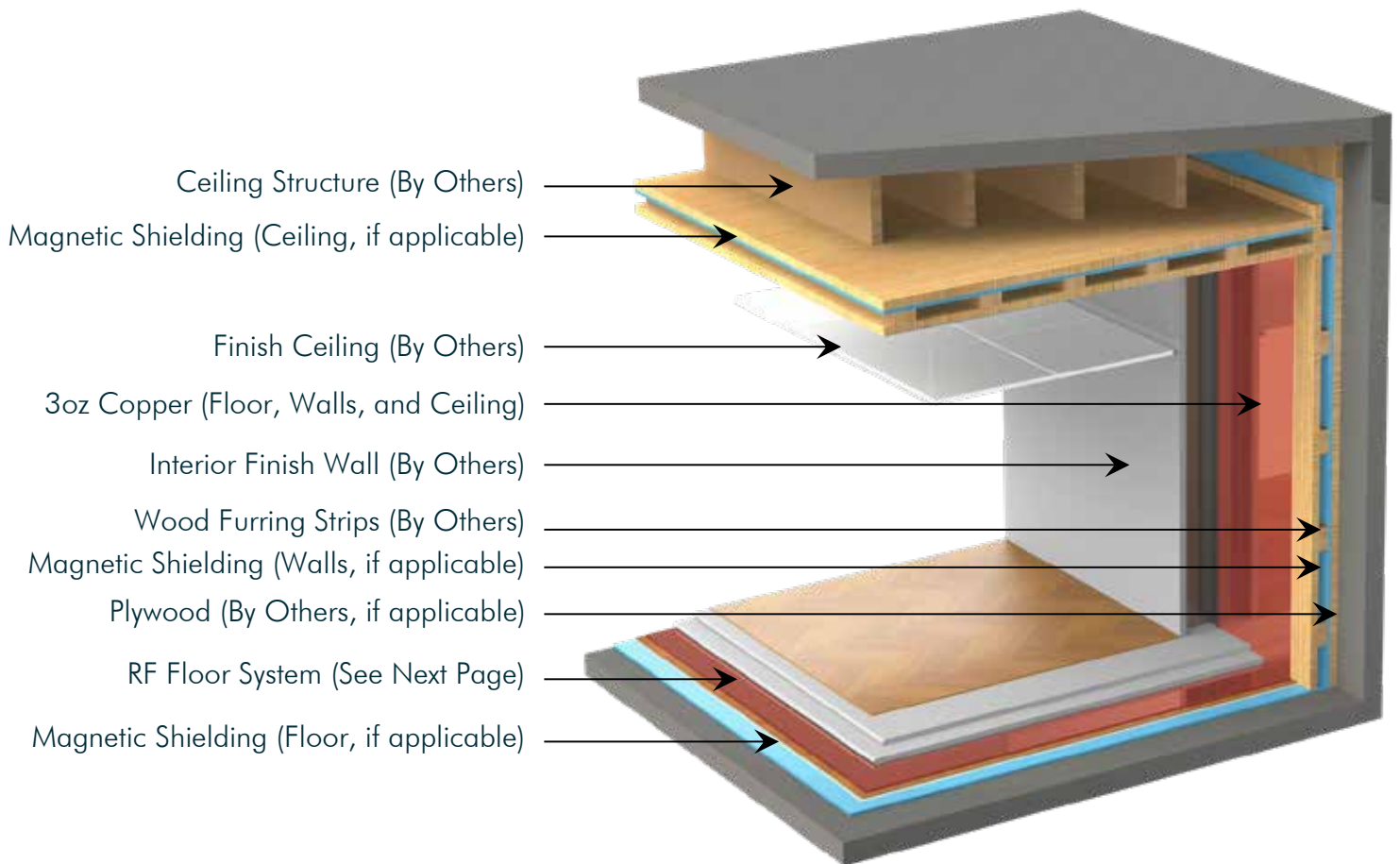
When Protection And Safety Must Be Absolutely Assured

www.marshield.com



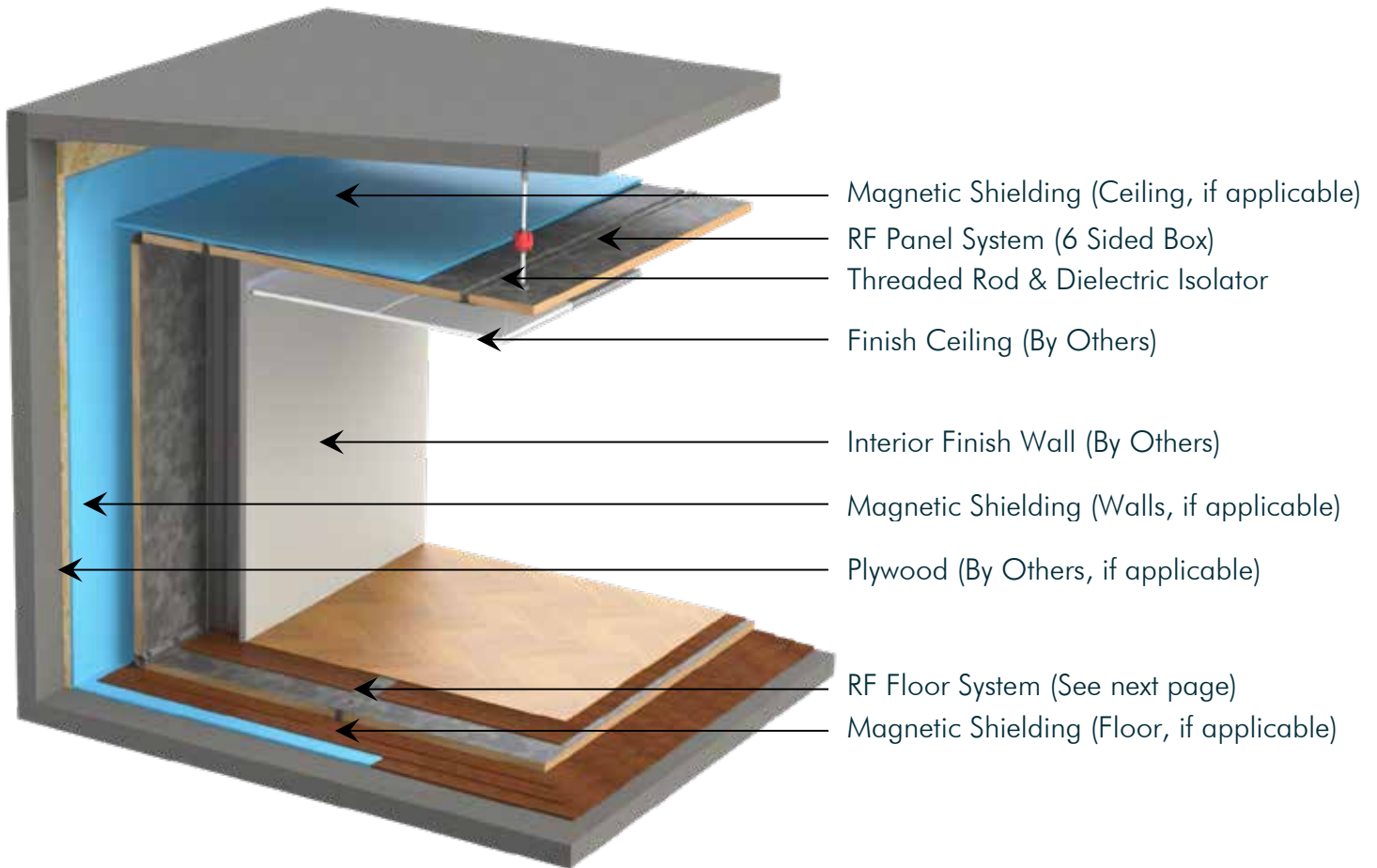
RF COPPER SYSTEM

This non-ferrous enclosure is ideal for shielding applications with restricted site access. The lightweight copper makes for easy navigation through job sites with limited space. Copper sheets attached to a plywood substrates and the copper is soldered together at all seams. The plywood, framing, and support are completed by others. The copper material is easily adaptable to various room configurations and is accepted for a wide array of applications. This shielding system will perform beyond the attenuation levels required for all major OEM's.



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 will be supported via threaded rod and dielectric isolators attached to the deck above. Shield will perform beyond the attenuation levels required for all major OEM's



AUTO-LATCH RF DOOR



DOOR SECURITY

The high-security latching mechanism ensures the door is secure and no person without access can enter.



DOOR SAFETY

The automatic door closer makes sure the door closes at all times. It works in tandem with the high-security latch to eliminate accidental walk-ins.



ACCESS CONTROL

The GT Auto-Latch doors electrical components allow for access control to only approved persons. It is compatible with all card-reader and keypad options.



HIGH-SECURITY LOCKSET

Mul-T-Lock's mechanical platform integrates advanced technology for premium security together with advanced & heightened key control.

PLUG & PLAY



Control Box (Mounted above the ceiling)

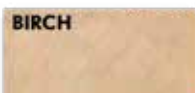


Mul-T-Lock Keying (Standard on lockset and key switch)



Key Switch with LED Indicator

Access Control Device (By Others)



STAINLESS STEEL

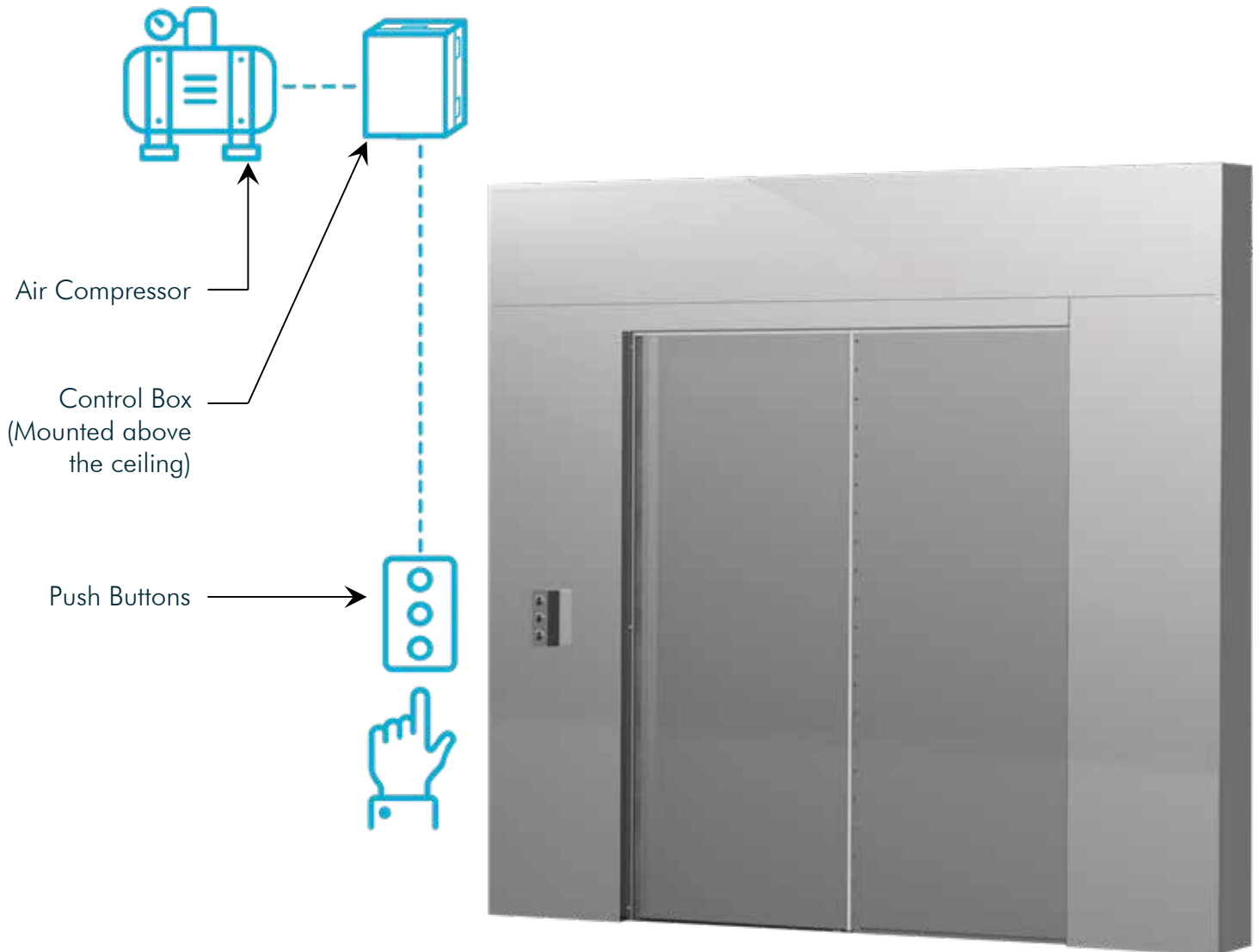
NO AIR REQUIRED



MRI/RF SHIELDING

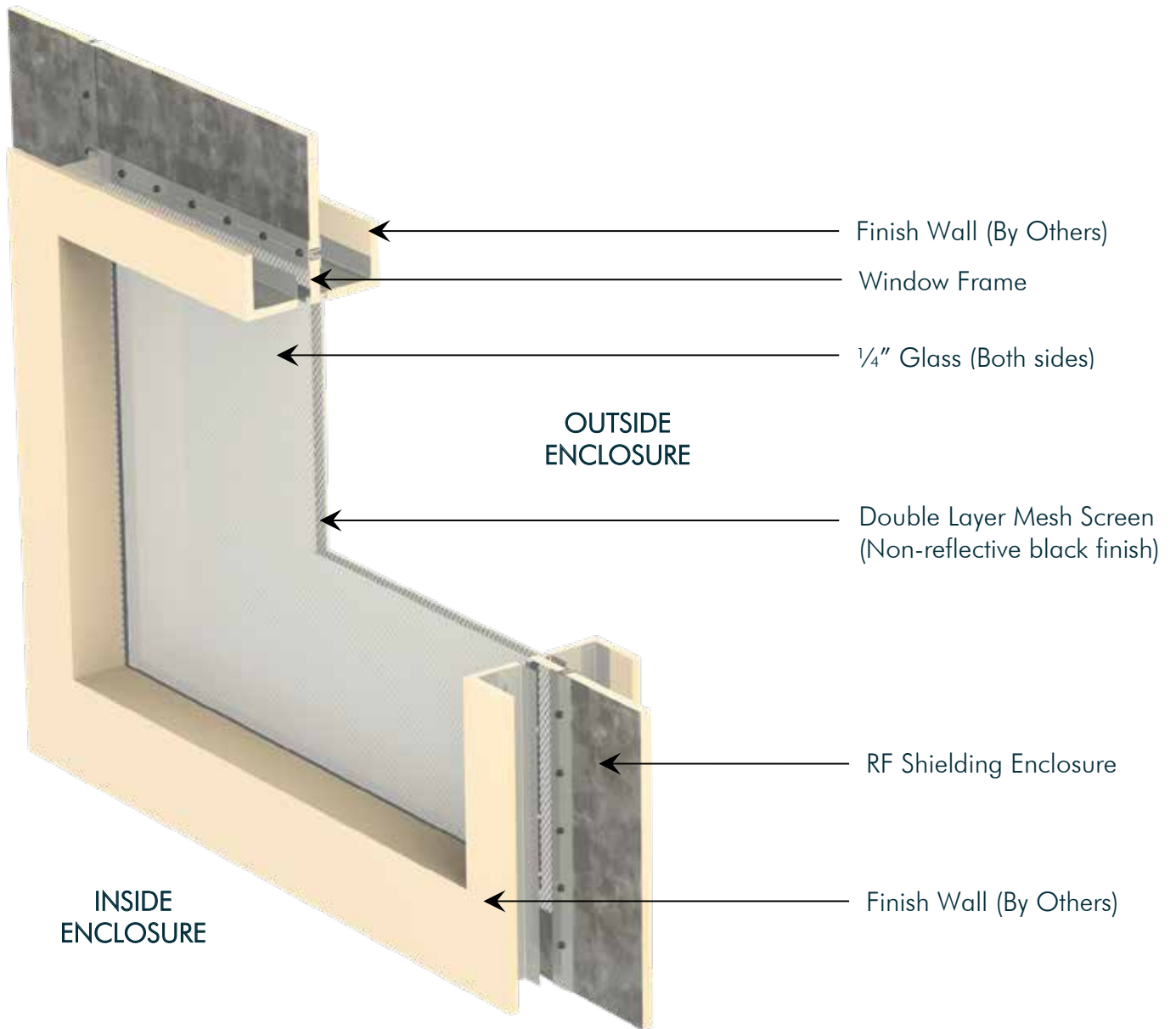
SLIDING RF DOOR

Our fully automatic Sliding RF Door features a completely pneumatic operating system and stainless steel design ideal for multiple bay operating suites. This door is offered in single or double leaf designs and offers similar safety and security features as our Auto-Latch RF Door.



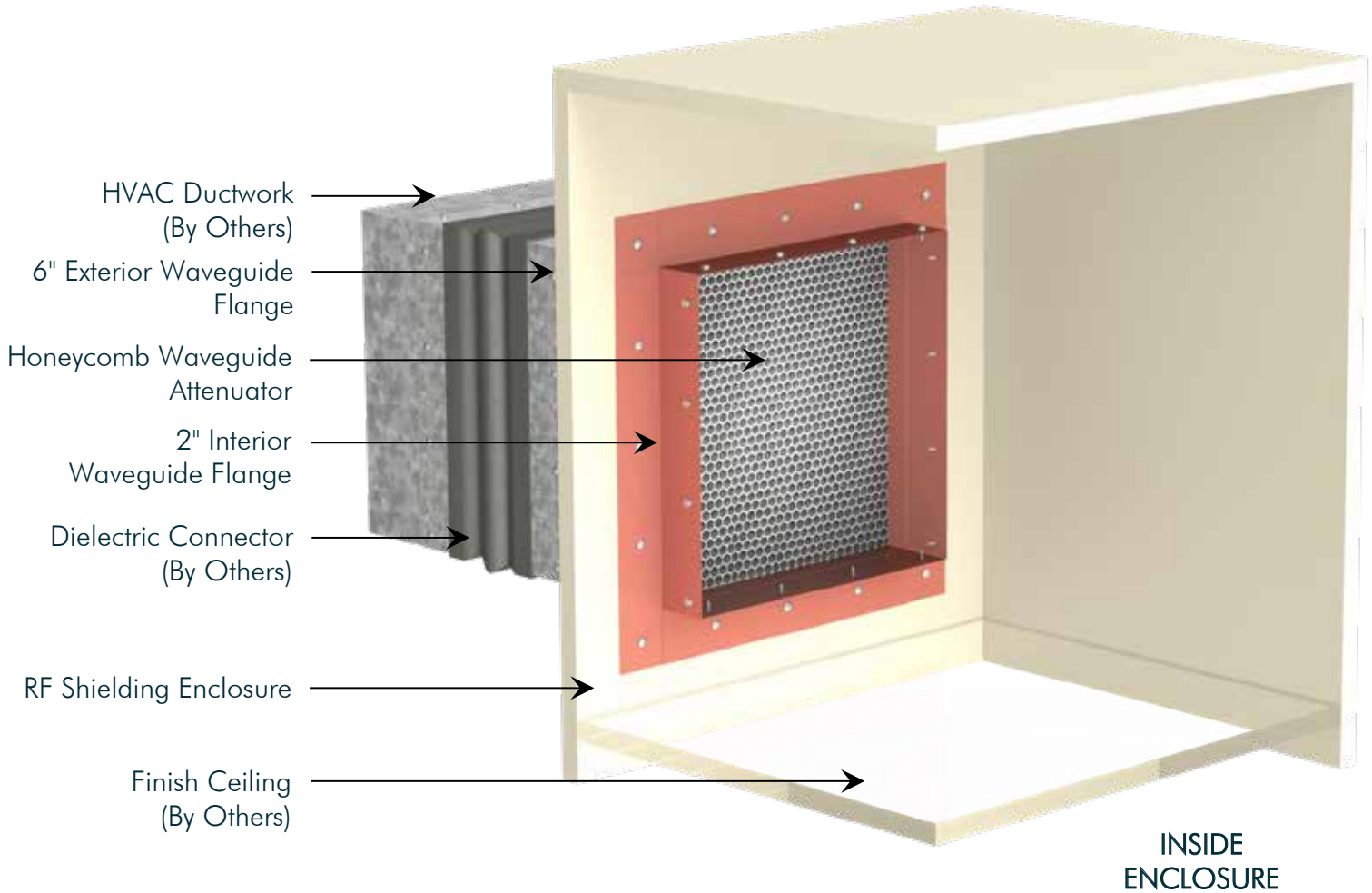
RF SHIELDED WINDOW

RF shielded windows are factory fabricated double layer, free of moiré pattern, non-reflective black coating with shielding equivalent to the enclosure.



RF WAVEGUIDE AIR VENTS

All HVAC access points into the RF shielded enclosure will be treated with a hex cell honeycomb waveguide vent assembly. The waveguide hex cell geometry is sized for optimal performance at the design specification.



1/4" x 3/4" HONEYCOMB CELL

Shielding Effectiveness

Magnetic		Electric		Planewave		Microwave		
1kHz	20kHz	100kHz	10MHz	100MHz	1GHz	10GHz	18GHz	40GHz
25dB	100dB	100dB	100dB	100dB	96dB	N/A	N/A	N/A

Pressure Drop

Inches of Water	0.065	0.095	0.1	0.15
At Feet Per Minute *	800	1,000	1,200	1,400

* Multiply by area to obtain CFM

RF TESTING PROCEDURES

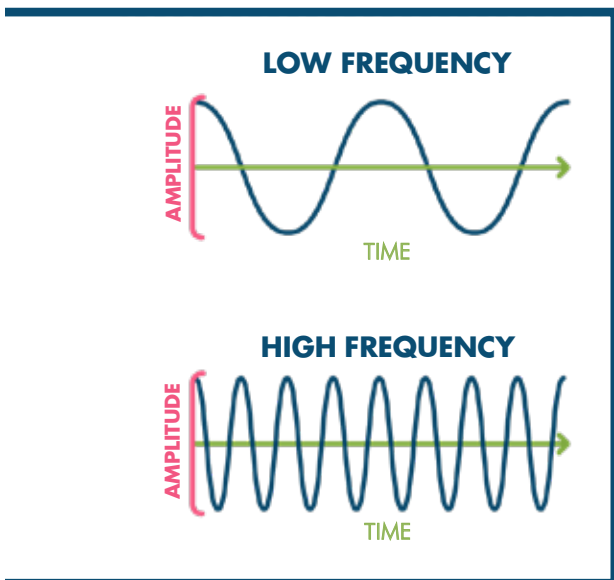
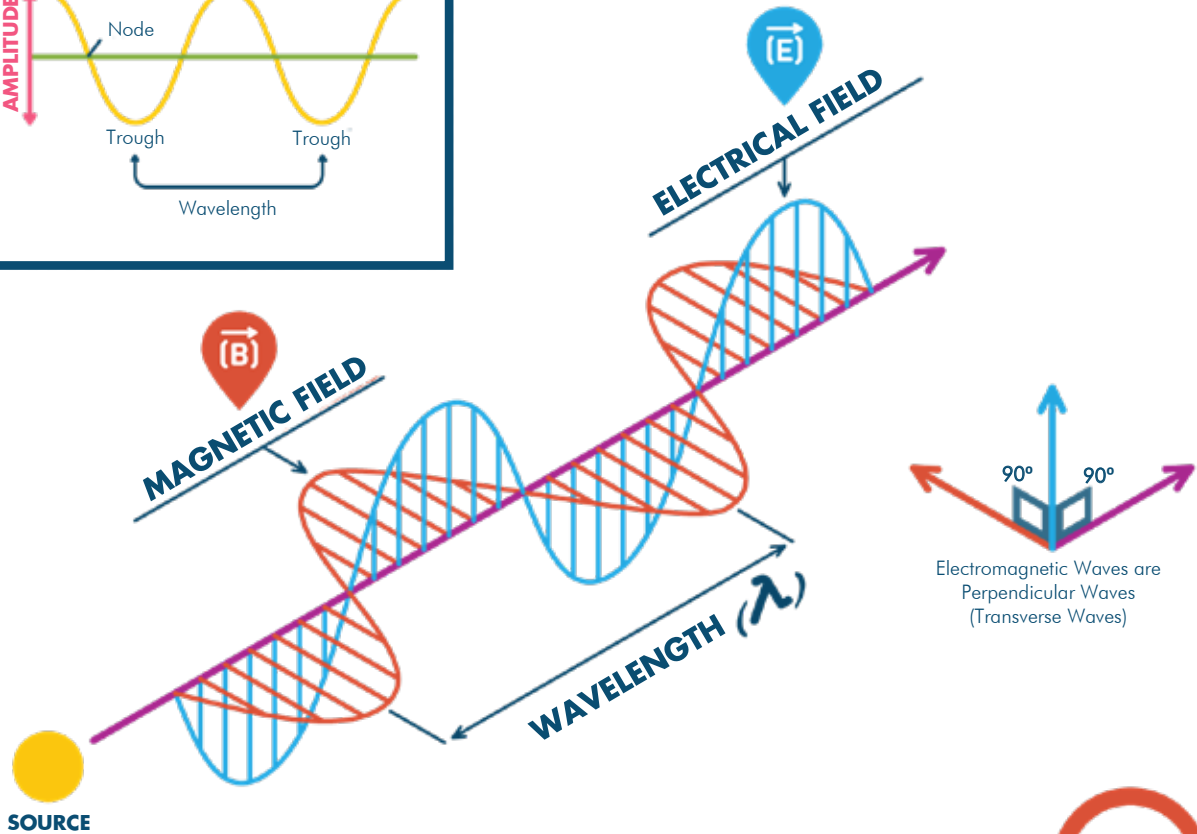
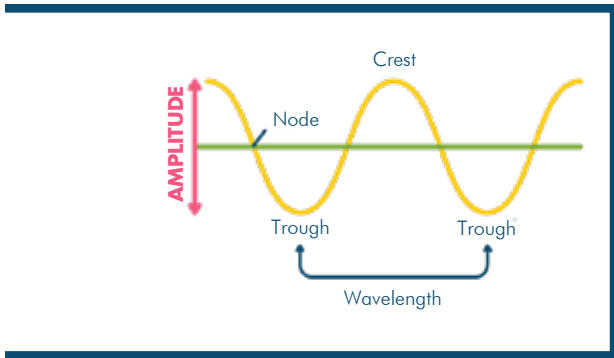
CERTIFICATION PROCESS

MRI equipment utilizes a strong magnetic field to generate images. To obtain the optimal performance 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 most MRI equipment is from 50 MHz to 150 MHz. To determine the Shielding Effectiveness (SE) a series of test 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 specified by the equipment vendor. To simplify the explanation of this process we will omit the technical details and focus on the general ideas behind the testing procedure. 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. Then the technician takes the Receive Antenna (RX) inside the enclosure and closes the door. The Shielding Effectiveness (SE) is then determined by the difference in dB once the door is closed. This difference in value is typically referred to as the shielding attenuation. Below is chart that illustrates the enclosure performance levels based on the attenuation value.

Grade	Measurement (dB)										
	< 50	60	65	70	75	80	85	90	95	≥ 100	
A+											Excellent ¹
A								Good ²			
B						Average ³					
C				Moderate ³							
D		Poor ⁴									
F	Severe ⁵										

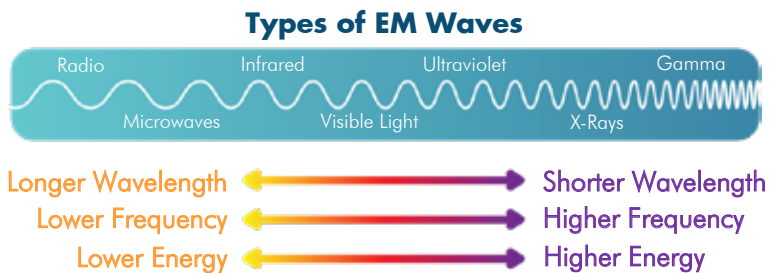
1. Enclosure is at optimum performance
2. Enclosure is at decent performance
3. Enclosure is substandard (Door should be evaluated for maintenance)
4. Enclosure is compromised (Should investigate for RF leaks)
5. Enclosure is severely compromised (Should investigate for RF leaks, possible shield replacement)

ELECTROMAGNETIC WAVES



EM Speed	
Vacuum	300,000 km/s
Air	Less than 300,000 km/s
Water	226,000 km/s
Glass	200,000 km/s
Diamond	124,000 km/s

300,000 km/s
Speed of Light



CRYOGEN VENT SYSTEMS

Cryogen vent systems are an essential part to a MRI's functionality. MRI machines use liquid helium to cool down the superconductive magnet's coil. As cryogens are released to keep the magnet cool, they evaporate into odorless, colorless, and tasteless gases and must be vented safely out of the building with the use of a cryogen vent pipe. We specialize in the supply and installation of these pipe systems. We are familiar with the different specifications of each magnet and can assist in the design calculations before the system is installed.



FOUR DECADES OF TRUSTED EXPERIENCE



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