

UNDERFLOOR

PLENUM CONSTRUCTION GUIDE

INTRODUCTION TO PLENUM INTEGRITY

WHY IS PLENUM INTEGRITY IMPORTANT?

Underfloor air distribution is a HVAC system that uses a pressurized raised access floor plenum to supply conditioned air through floor diffusers typically in the floor into a space.

The proper functioning of the underfloor air system is dependent on the pressure in the underfloor plenum. As a result, it is vital that the plenum is properly constructed and sealed to minimize leakage. The proper construction and sealing of the plenum is what is referred to as Plenum Integrity.

Although a marginal UFAD system may leak as much as 20% to 25% of the systems total air volume, it is important to remember that overhead duct systems leak an average of 20% of their airflow, and that leakage flows to the return-air airway and not to the occupied space.

In general, the goal is to maintain maximum plenum integrity to minimize keep leakage within acceptable levels.

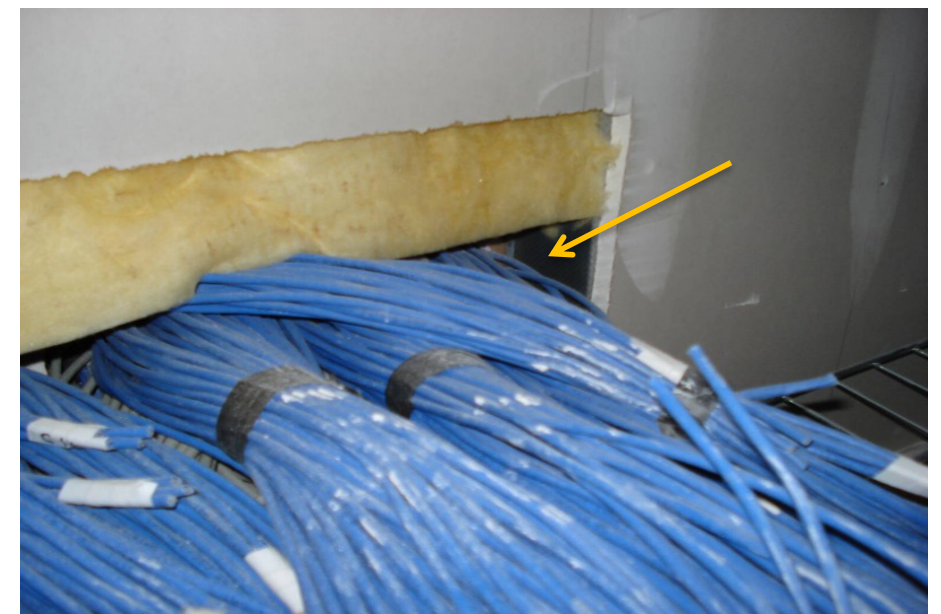
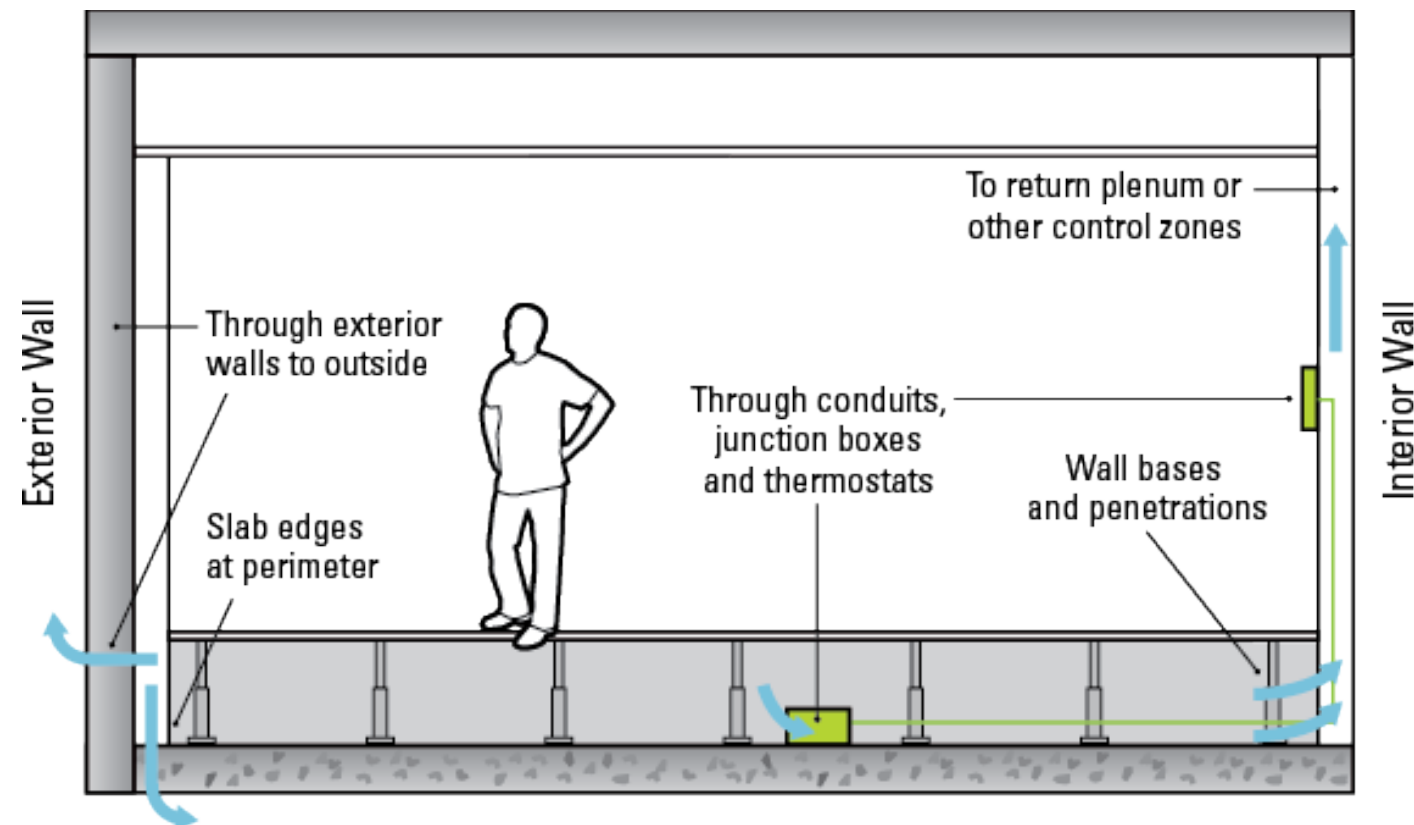


PLENUM CONSTRUCTION AND INTEGRITY

TYPES OF LEAKAGE

There are primarily two major types of leakage to be concerned about.

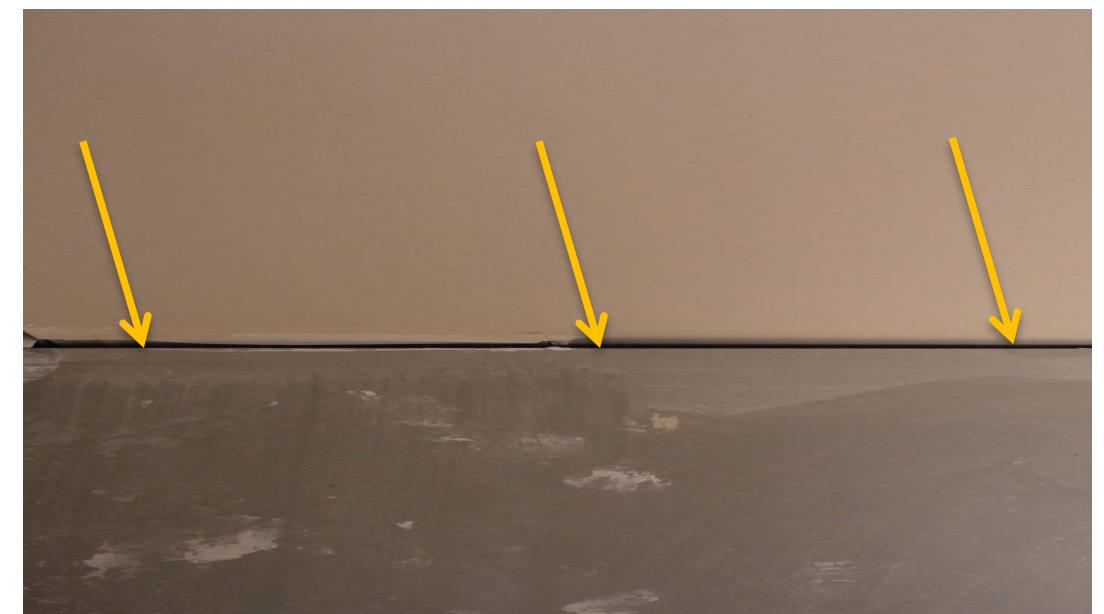
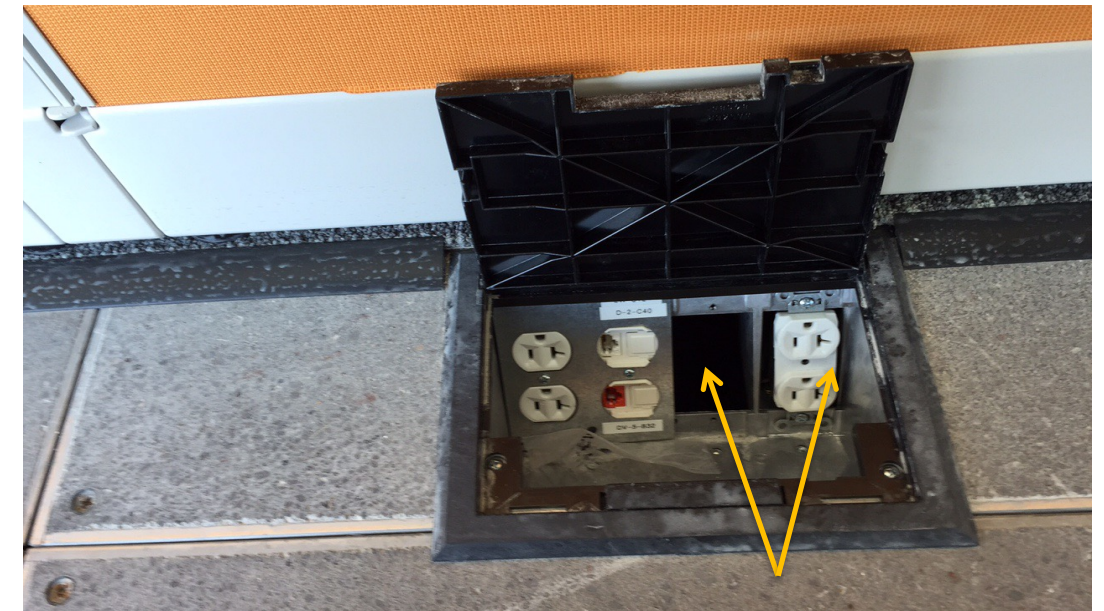
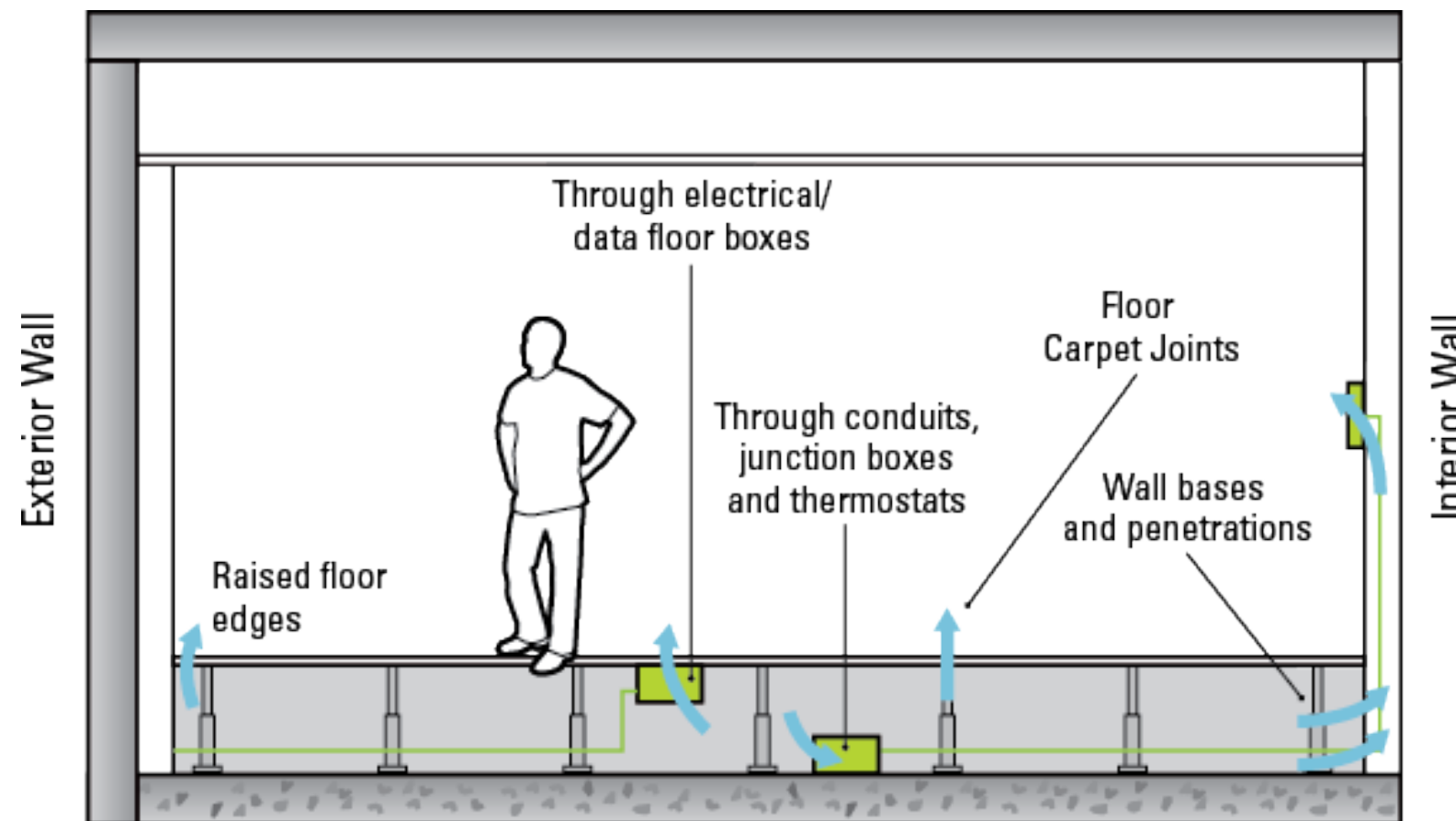
- **Category I Leakage** – Supply air bypasses the space leaking into the interstitial and exterior space. This could have the following impact;
 - Under cooling of the space
 - Under ventilation of the space
 - Excessive fan use to try to achieve plenum pressure
 - Over cooling of return due to short circuiting



PLENUM CONSTRUCTION AND INTEGRITY

TYPES OF LEAKAGE

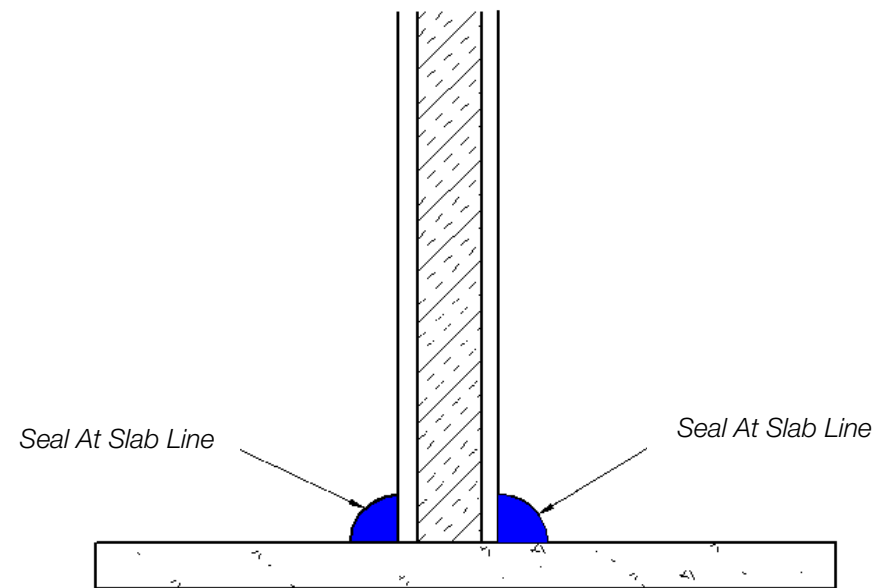
- **Category II Leakage** – Air leaks into the occupied space through holes openings or penetrations in the floor or walls. Although not detrimental to the operation of the system it can create comfort and control issues by over cooling of the space



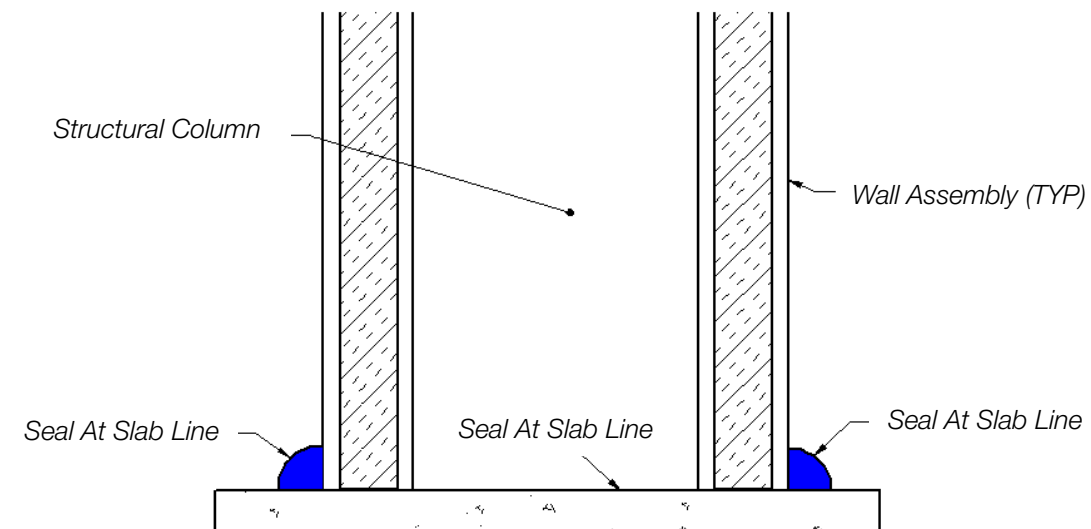
PLENUM CONSTRUCTION AND INTEGRITY

PLENUM SEALING SCHEMATICS AND DETAILS

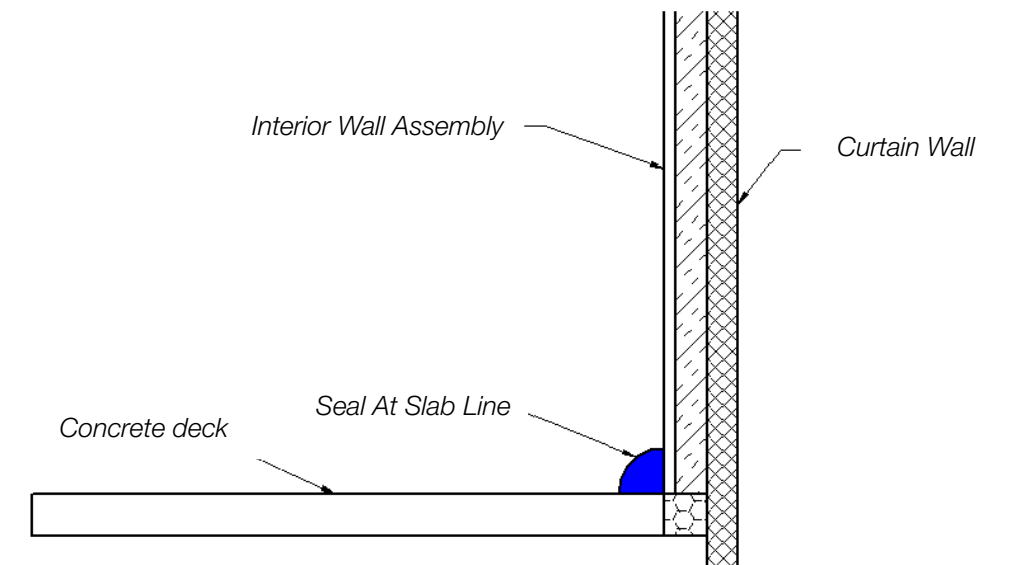
DETAIL A: INTERIOR WALL



DETAIL B: COLUMN WRAP



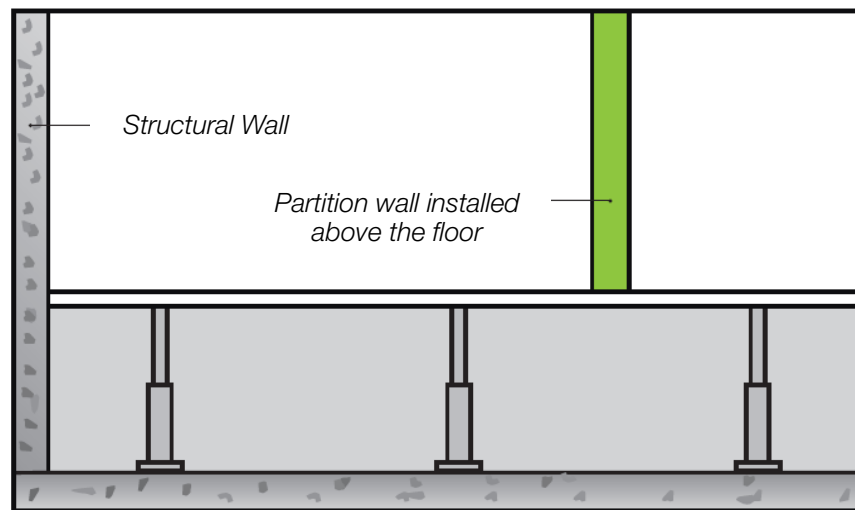
DETAIL C: PERIMETER WALL



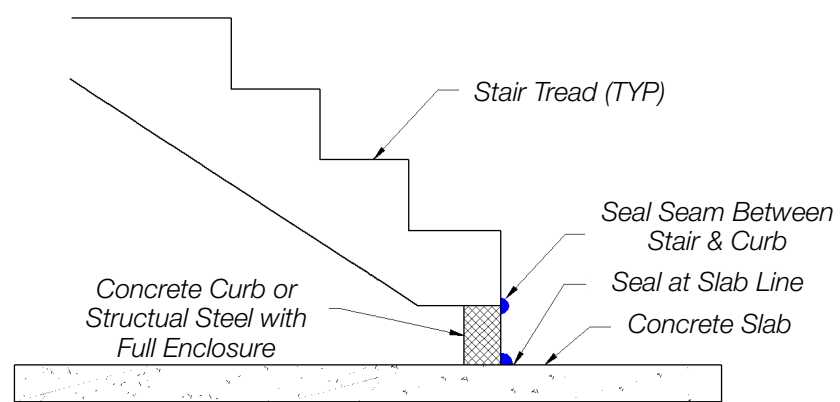
PLENUM CONSTRUCTION AND INTEGRITY

PLENUM SEALING SCHEMATICS AND DETAILS

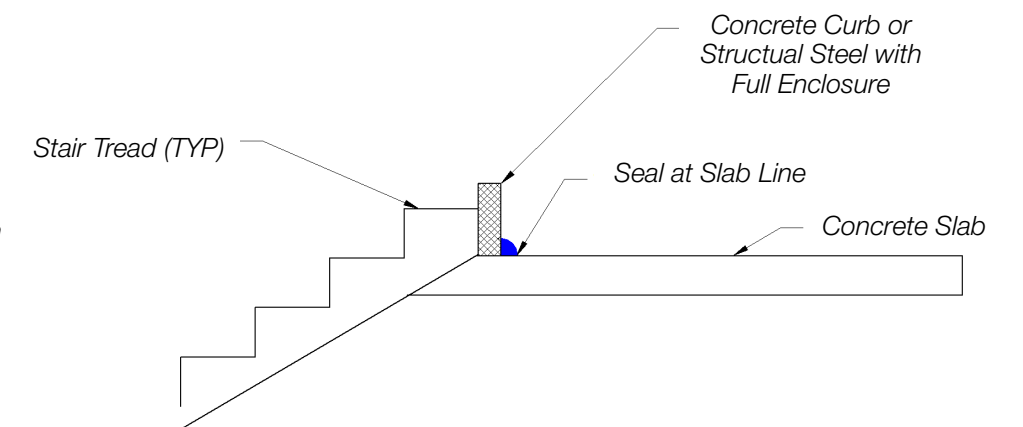
DETAIL D: PARTITION WALL



DETAIL E: BASE STAIR ON CONCRETE SLAB



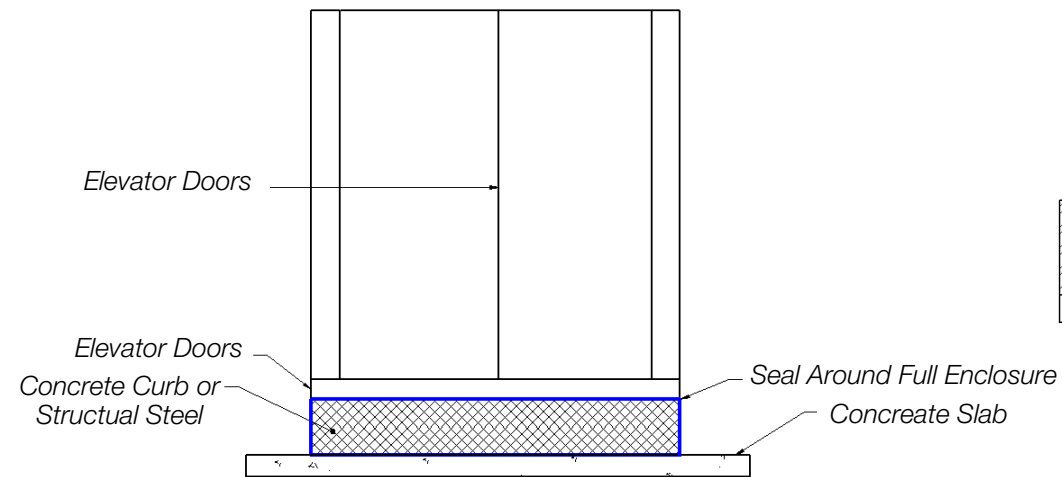
DETAIL F: TOP OF STAIR AT CONCRETE DECK



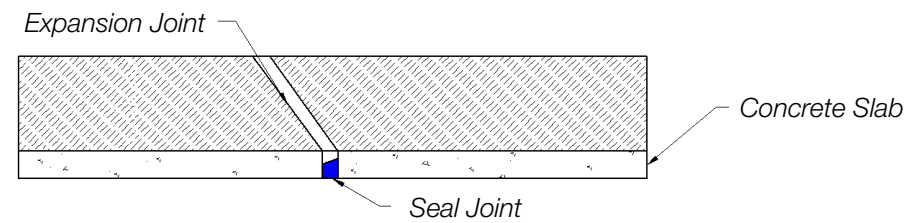
PLENUM CONSTRUCTION AND INTEGRITY

PLENUM SEALING SCHEMATICS AND DETAILS

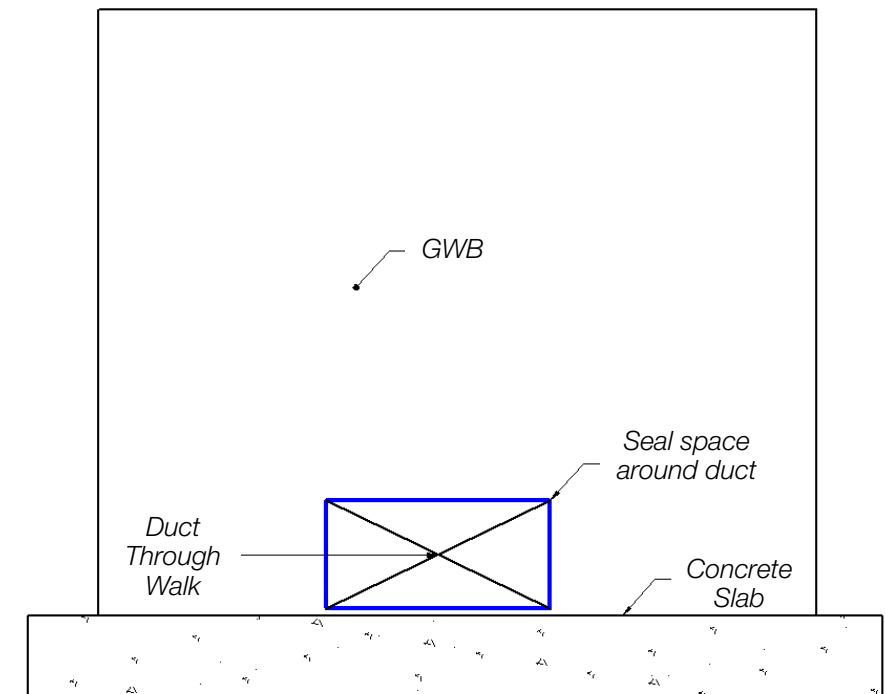
DETAIL G: ELEVATOR SHAFT BELOW ACCESS FLOOR



DETAIL H: EXPANSION JOINT IN CONCRETE SLAB



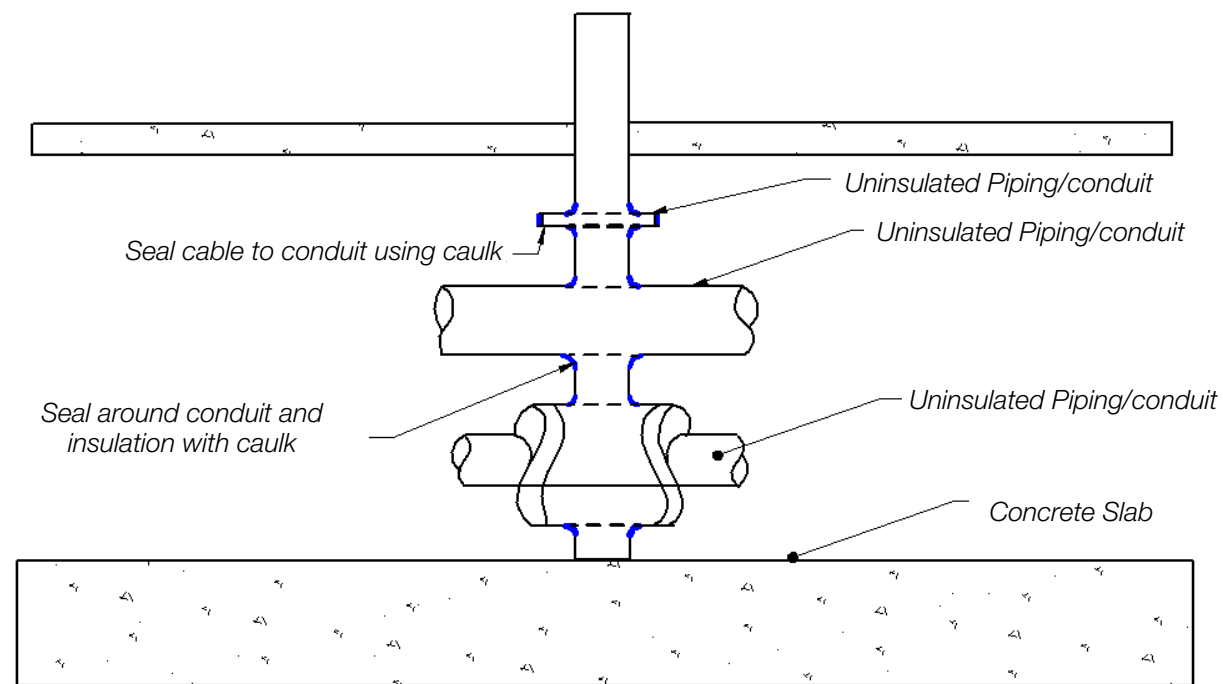
DETAIL I & K: PLENUM WALL DUCT OPENING



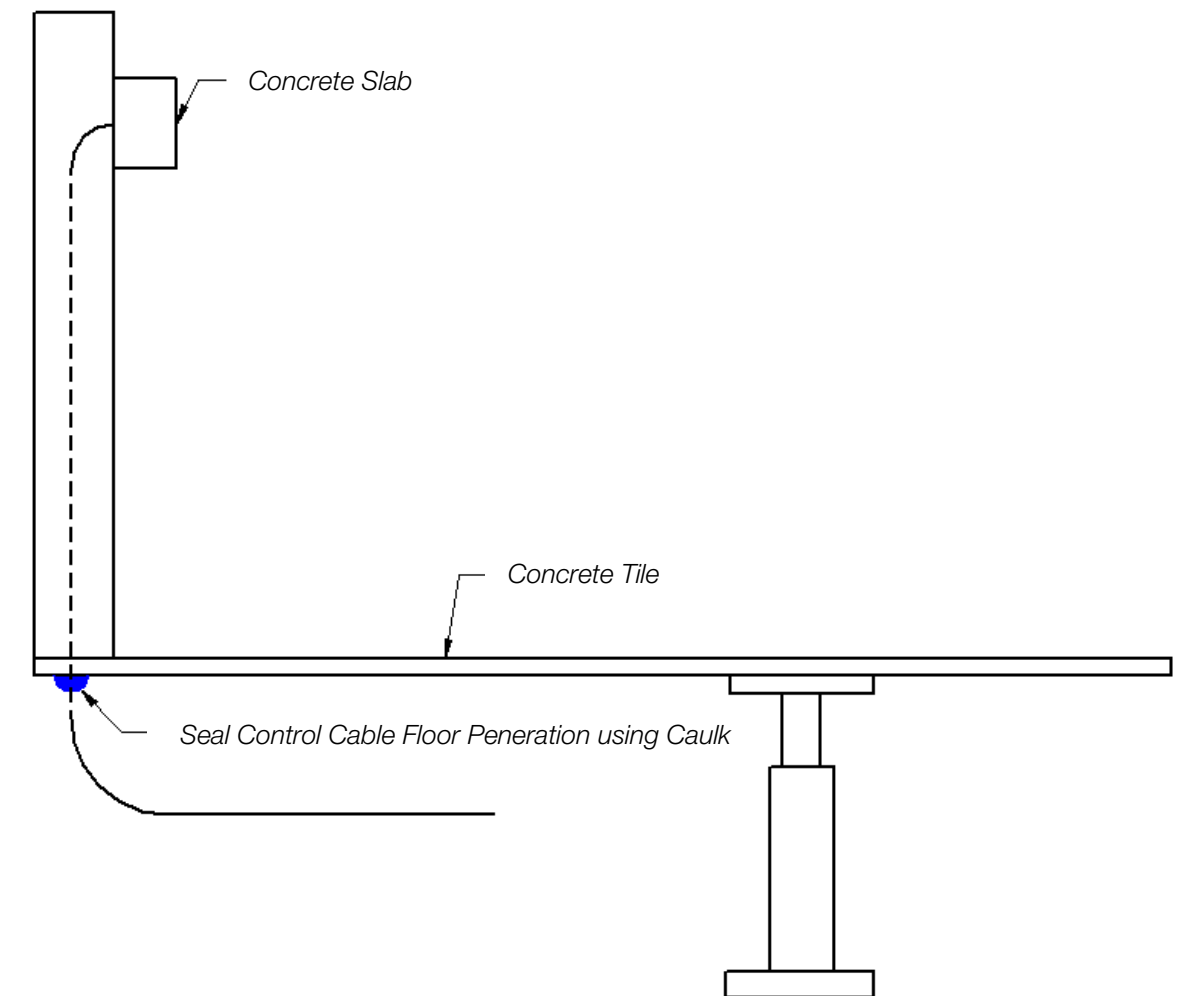
PLENUM CONSTRUCTION AND INTEGRITY

PLENUM SEALING SCHEMATICS AND DETAILS

DETAIL J: PLENUM WALL CONDUIT / PIPE OPENING



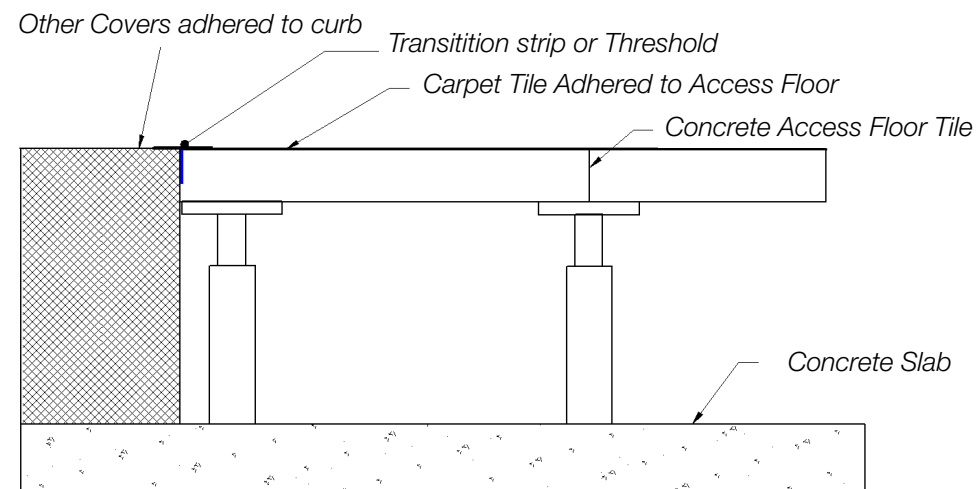
DETAIL L: OPEN ENDS OF CONDUITS IN THE PLENUM



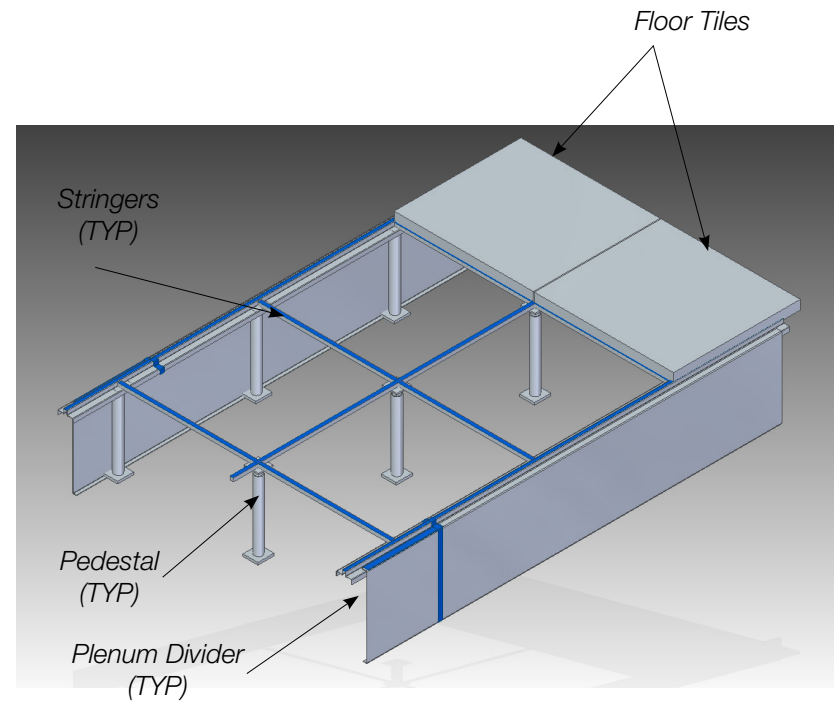
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PLENUM SEALING SCHEMATICS AND DETAILS

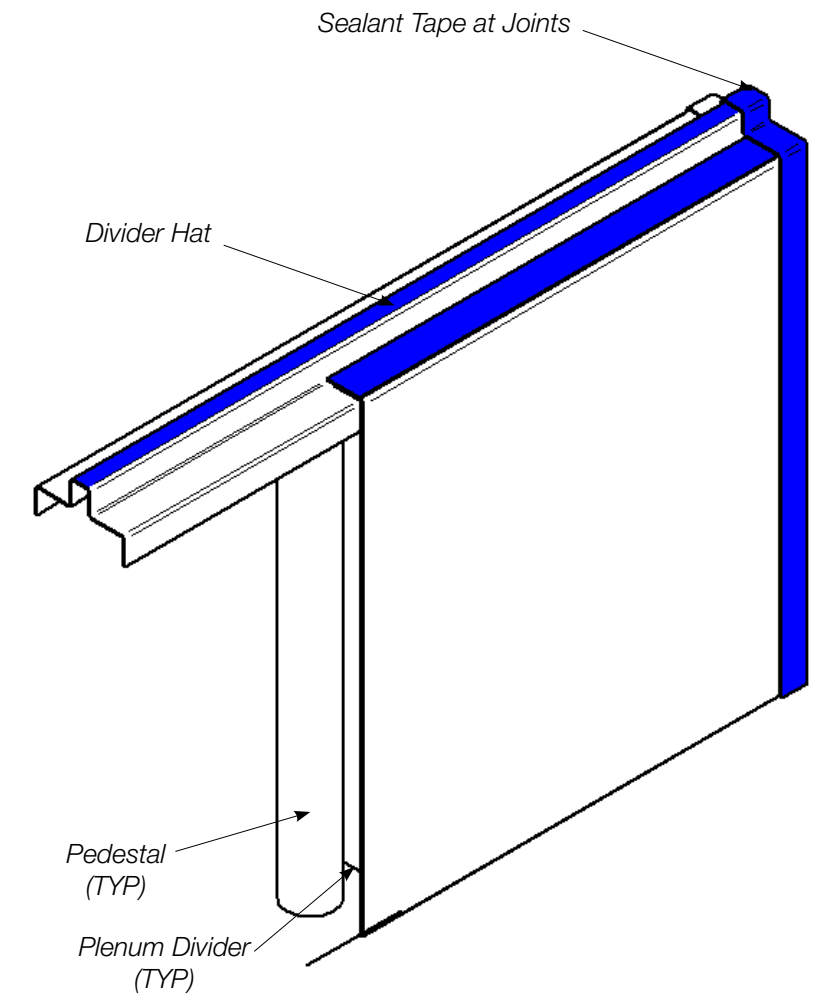
PERIMETER SEAL AT CURB WITH
TRANSITION



AIR HIGHWAY
NOT RECOMMENDED



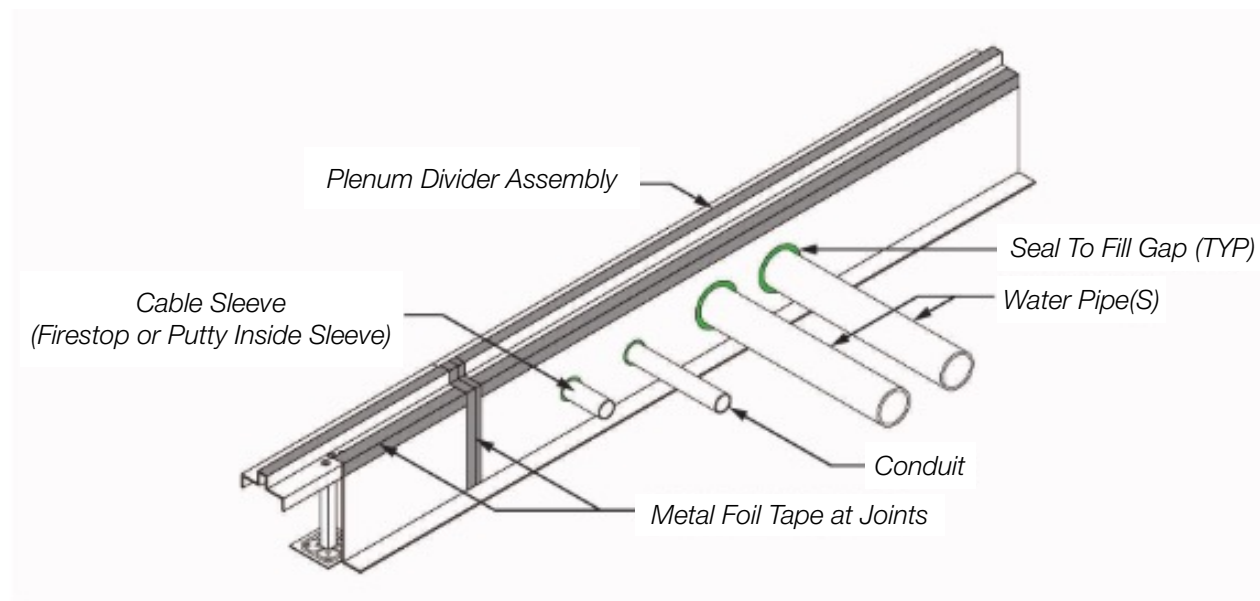
PLENUM DIVIDER



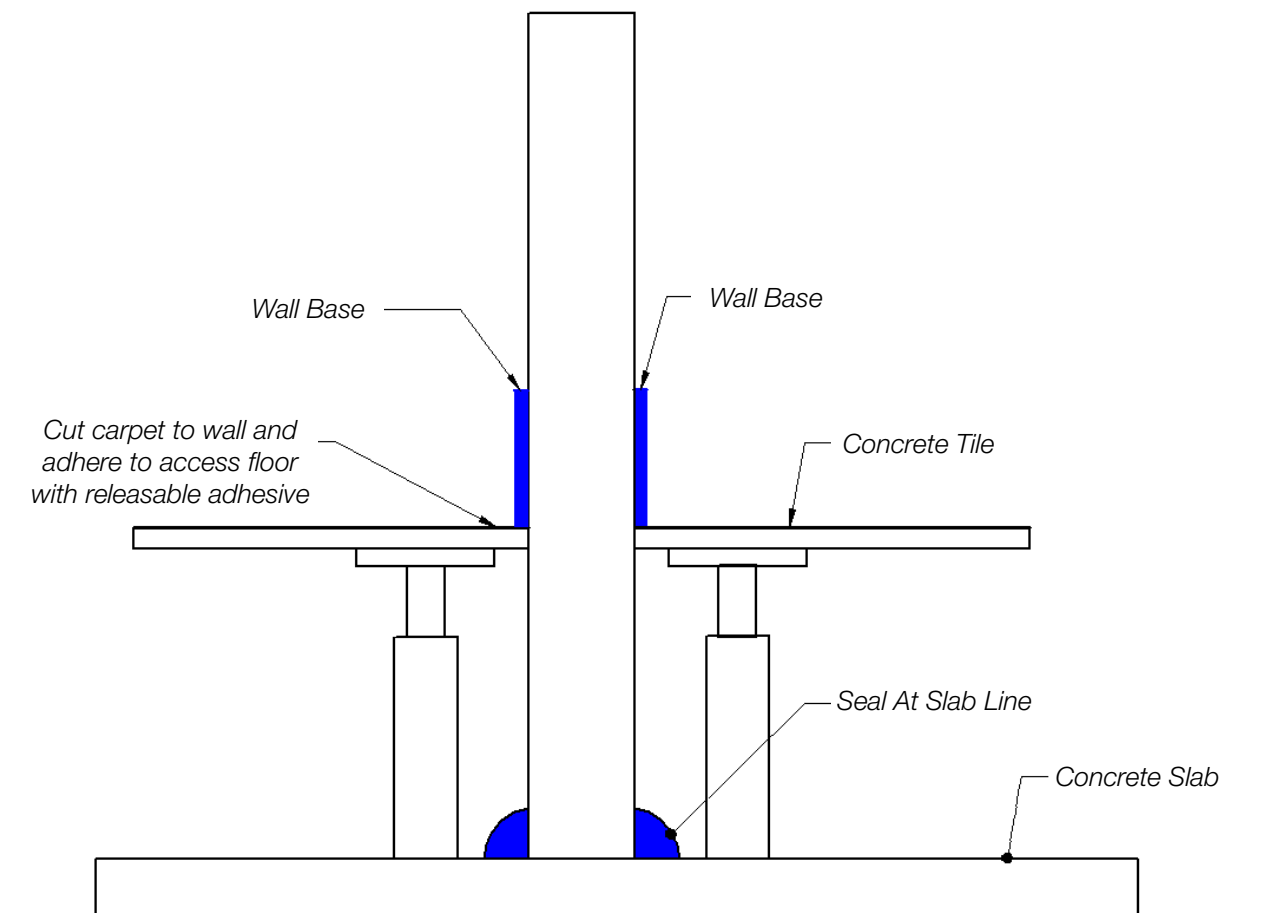
PLENUM CONSTRUCTION AND INTEGRITY

PLENUM SEALING SCHEMATICS AND DETAILS

PLENUM WALL PENETRATION



PERIMETER SEAL WITH WALL BASE



PLENUM CONSTRUCTION AND INTEGRITY

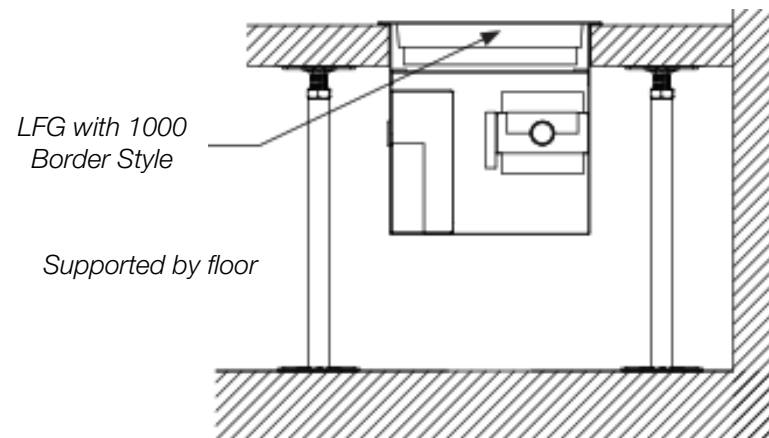
PLENUM SEALING SCHEMATICS AND DETAILS – PERIMETER TROUGH

The design of a building perimeter/façade and how it is conditioned can vary significantly from one building to the next and as a result more care should be taken to ensure proper sealing at the façade.

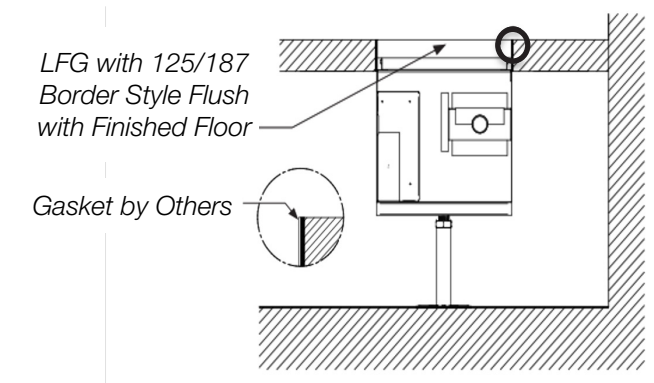
The details show the typical sealing when the perimeter unit plenums are installed with flanges that allow them to be floor tile support and without flanges (flangeless) in which case they are supported with pedestals or leveling feet.

In certain cases, a custom trough design and detail may be required as shown on the next page.

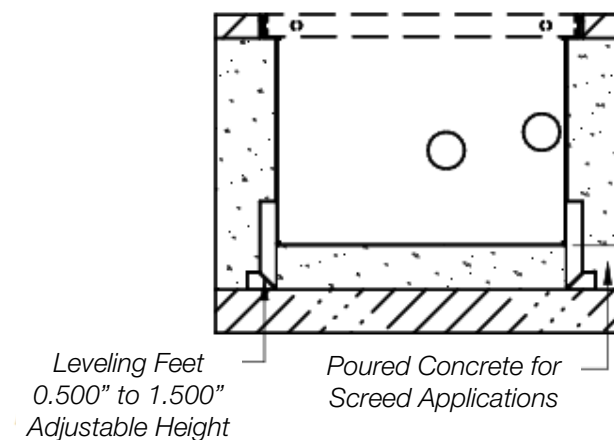
FLANGED PLENUM



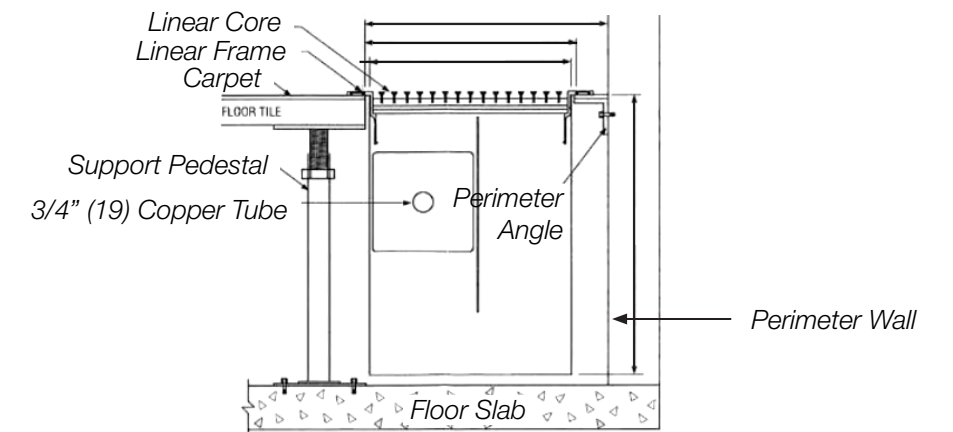
FLANGELESS PLENUM



SELF-SUPPORTED PLENUM
(FAN TROUGH ONLY)



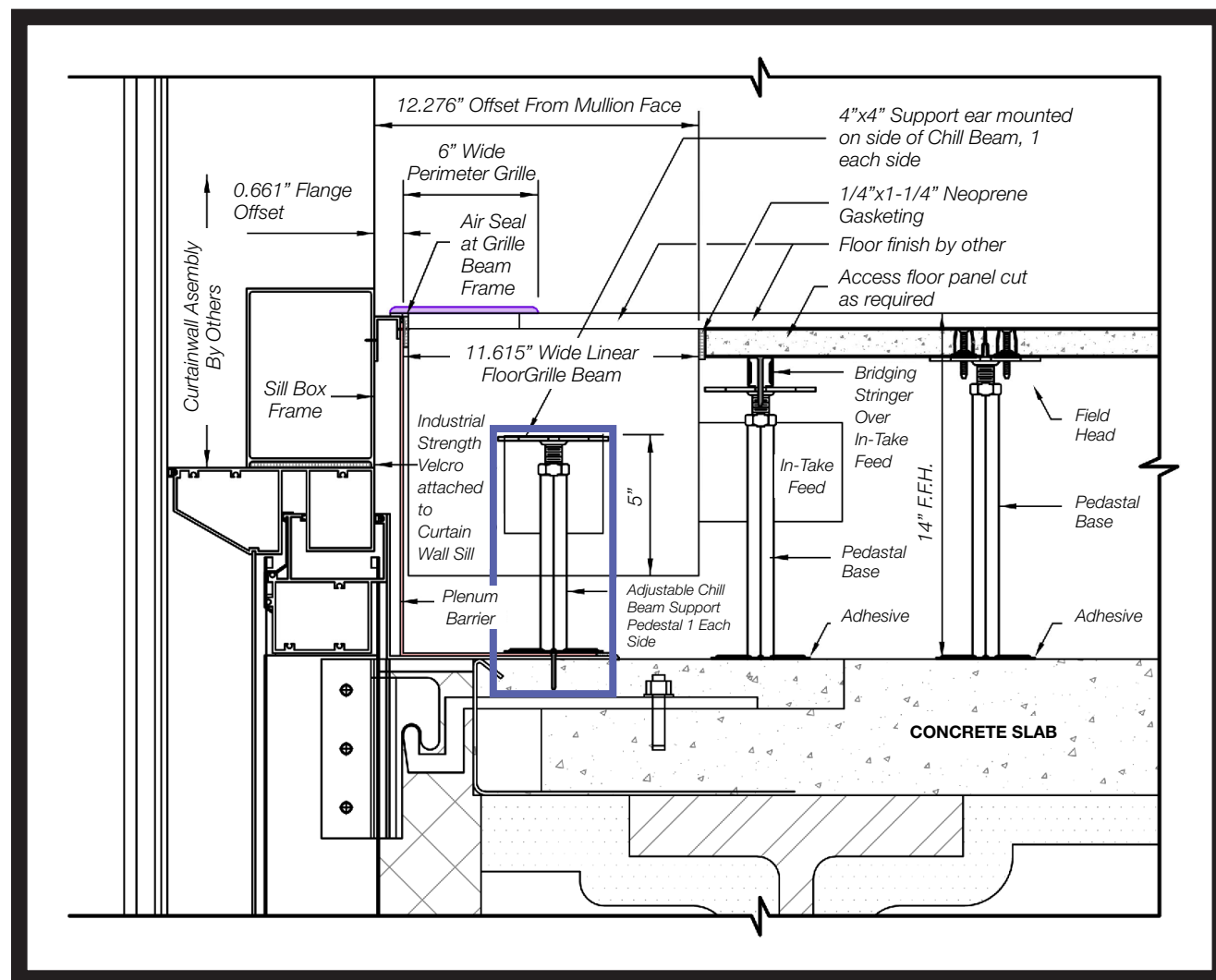
FLANGED PLENUM WITH WALL ANGLE



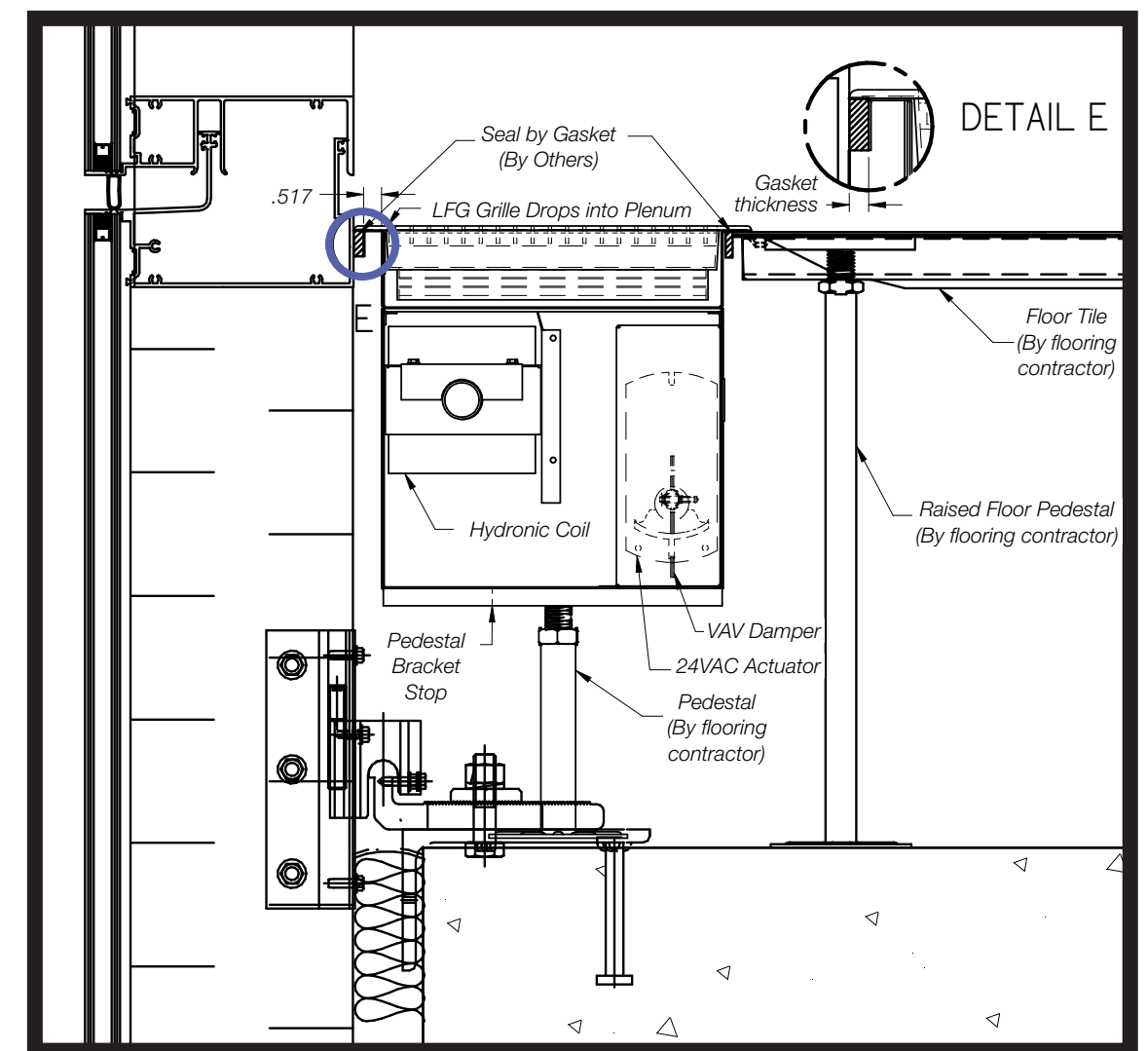
PLENUM CONSTRUCTION AND INTEGRITY

EXAMPLE OF PLENUM SEALING SCHEMATICS AND CUSTOM DETAILS

PERIMETER TROUGH SIDE FLANGES/PEDESTAL DETAIL



PERIMETER TROUGH WITH CUSTOM ANGLE FOR VERTICAL SEAL



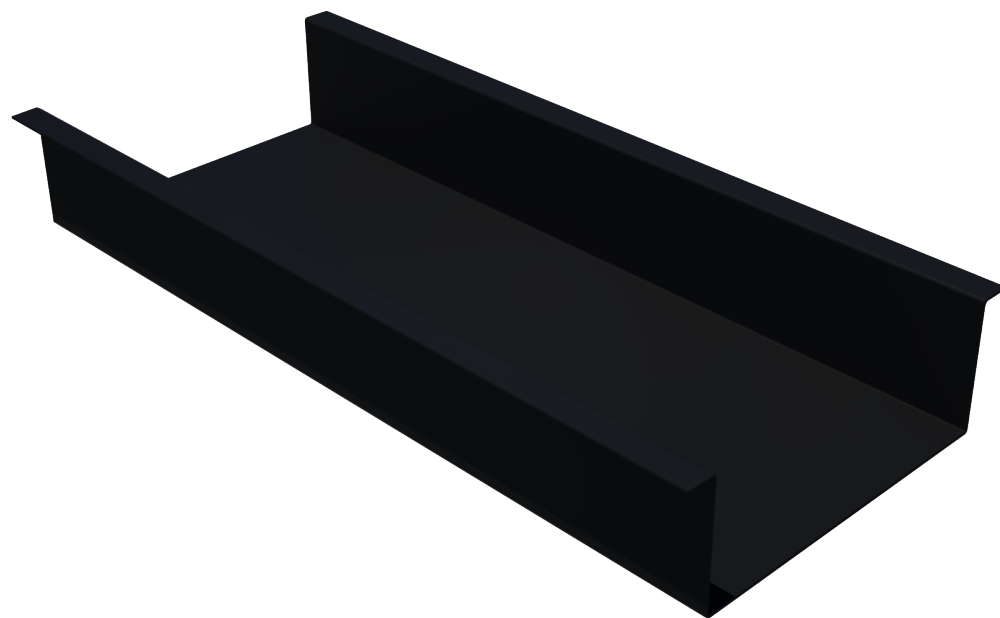
PLENUM CONSTRUCTION AND INTEGRITY

PLENUM SEALING SCHEMATICS AND DETAILS – PERIMETER BLANK-OFF SECTIONS

Blank-off Trough

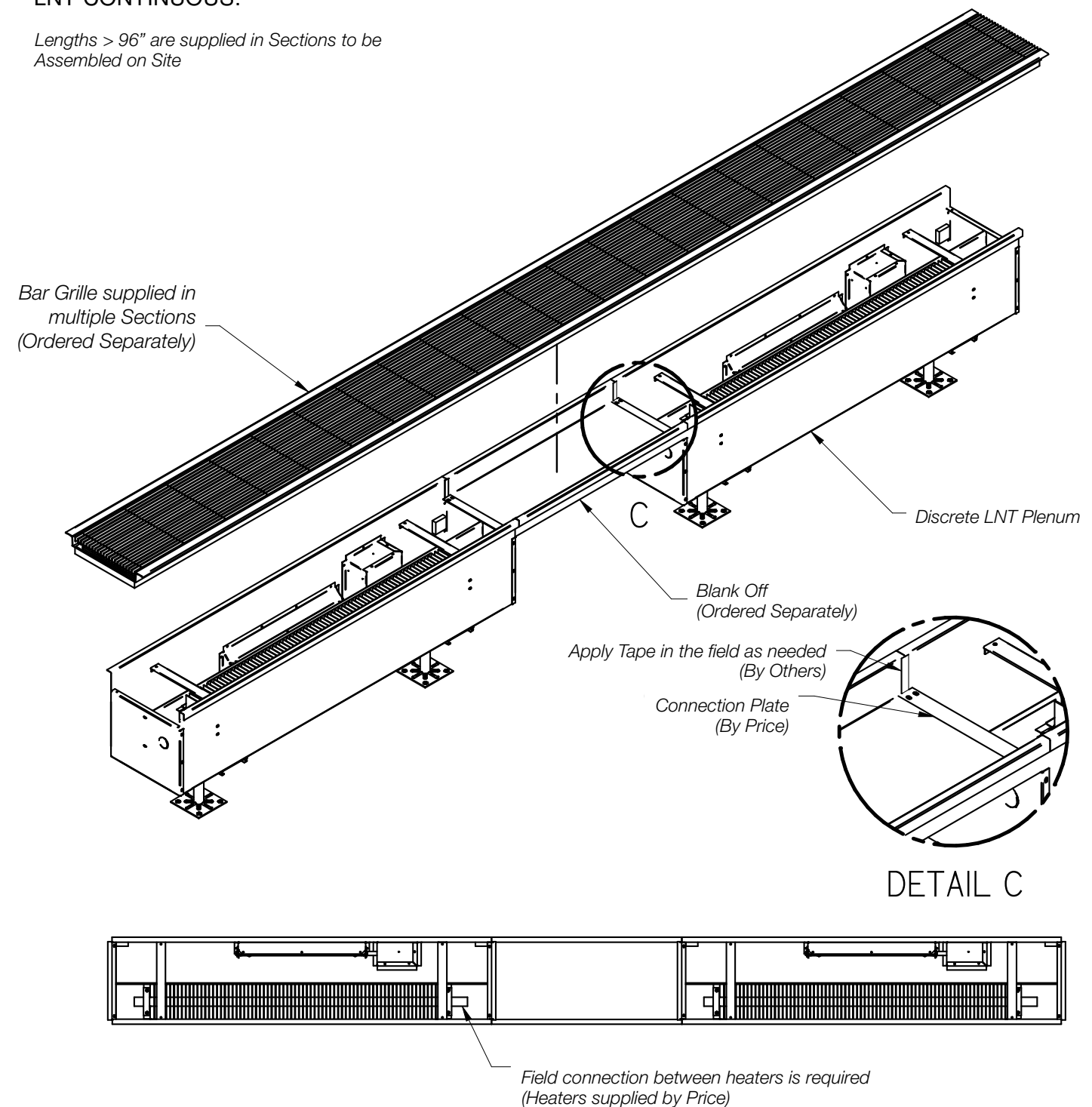
The perimeter trough units would typically be designed to be used with continuous or discrete grilles. For continuous grille applications a blank-off trough may be required to be installed and sealed between the active perimeter trough units to support the grille and minimize leakage.

The blank-off trough can be used with flanged as well as with flangeless perimeter trough styles. The image shows the assembly detail of the blank-off trough section and its integration with the trough units.



LNT CONTINUOUS:

Lengths > 96" are supplied in Sections to be Assembled on Site



PLENUM INTEGRITY AND SEALING

LEAK TESTING METHODS AND PROCEDURES

Addressing leakage will involve an integrated construction process. Here is a recommended checklist for the different stages of the project;

- **Pre-bid meetings**

- ◇ Meet with all trades to review overall system design
- ◇ Review and inspect plenum integrity details and specification
- ◇ Identify plenum sealing requirements
- ◇ Determine and establish on-site inspection method and requirements

- **Pre-construction**

- ◇ Meet with all trades to review plenum integrity details and specification
- ◇ Determine and review contractor's methods to maintain plenum integrity
- ◇ Determine sequence of construction
- ◇ Determine method of documentation

- **Pre-installation**

- ◇ Inspect plenum prior to RAF installation
- ◇ Note and correct all plenum deficiencies



PLENUM INTEGRITY AND SEALING

ASHRAE RECOMMENDED LEAKAGE GUIDELINES

Category 1 Leakage	Category 2 Leakage	Total Leakage	Plenum Pressure	Source
0.05 cfm/ft ² (0.26 L/s/m ²)	0.1 cfm/ft ² (0.5 L/s/m ²)	0.15 cfm/ft ² (0.4 L/s/m ²)	0.05 in. wc (12.5 Pa)	Bauman et al. (2012)
8% of design flow or 0.05 cfm/ft ² (0.26 L/s/m ²) (whichever is less)	15% of design flow	23% of design flow	0.05 in. wc (12.5 Pa)	PEC (2007)

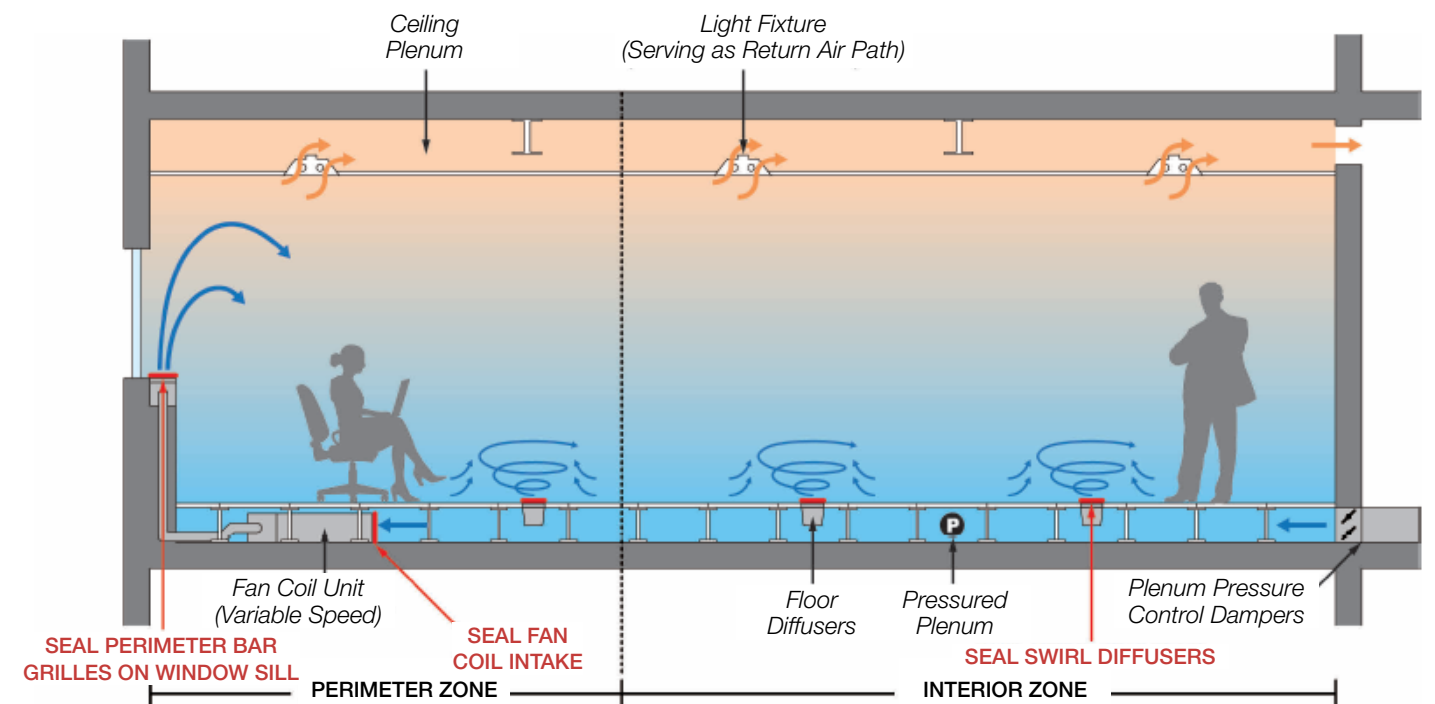
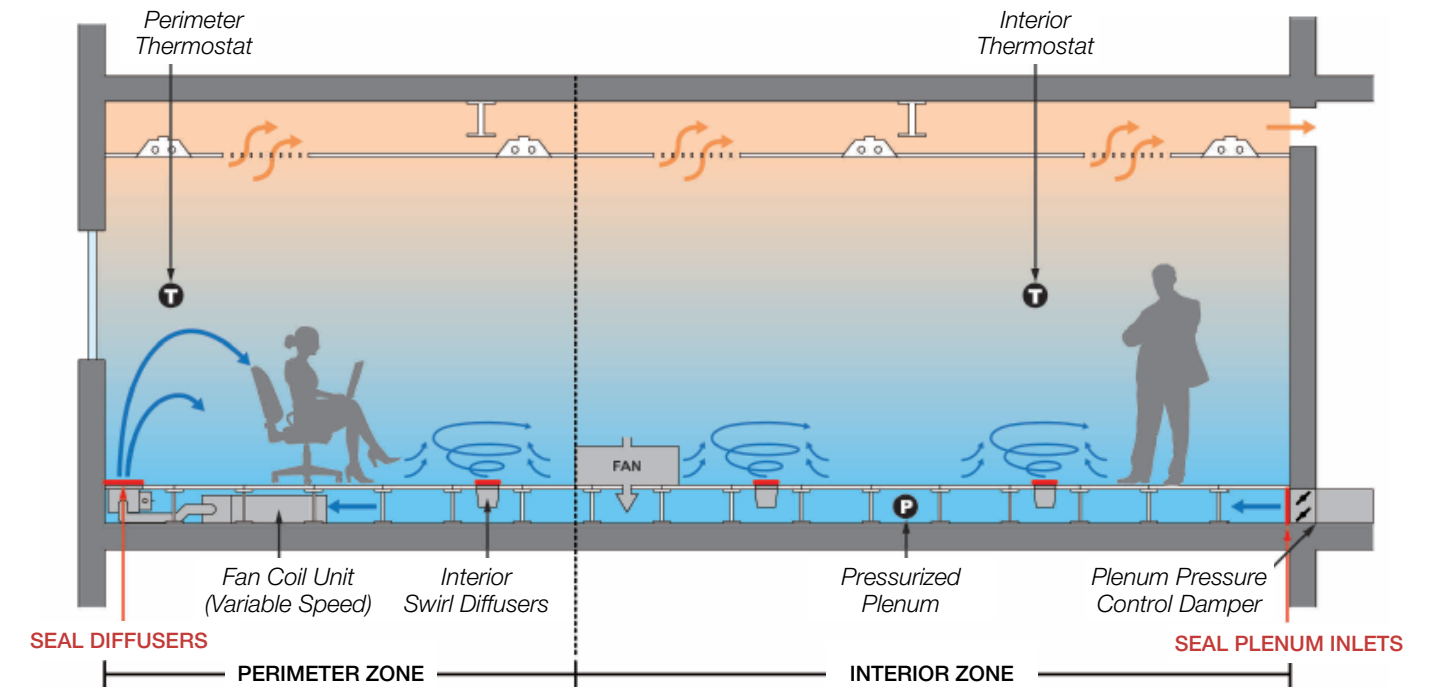
The ASHRAE UFAD guide recommends the allowable leakage limits shown on the table above. These limits provide guidance for the testing and balancing of an underfloor system.

PLENUM INTEGRITY AND SEALING

LEAK TESTING METHODS AND PROCEDURE

There are two methods commonly used for pressurizing the plenum when leak testing:

- **Method 1:** Using a blower panel Assembly – For this method the portion of the underfloor plenum to be tested is pressurized using a blower panel assembly installed and the room side and sealed.
 - The use of the fan blower provides better control and accuracy
 - This is ideal for smaller floor plates and partitioned areas
 - The fan may struggle to pressurize larger plenum zones
- **Method 2:** Using the building AHU – In this method the building AHU is used to pressure the underfloor plenum area designated for leakage testing.
 - This method is ideal for larger plenum zones and provides a more realistic test
 - The building controls may be required to be installed to run the AHU



PLENUM INTEGRITY AND SEALING

LEAK TESTING METHODS AND PROCEDURE

It is recommended that a portion of the underfloor project is tested for leakage prior to installation of all the raised access floor tiles. The general quality of construction of the underfloor plenum may be evaluated by this leakage test.

For Category I leakage testing:

- Seal all the floor and wall outlets, tile gaps and all edges around the walls with tape
- Seal all plenum inlets
- Install blower or calibrate system airflow sensor and plenum pressure sensors
- Ramp fan up to achieve design pressure
- Measured airflow represents Category I leakage

For Category II leakage testing ;

- Unseal all the floor and wall outlets, floor tile gaps and edges around wall note intended for air delivery
- Re-run the test
- The measured airflow represents the total leakage (Category I and Category II)
- Calculate Category II Leakage by subtracting Category I leakage from the total measured leakage



PLENUM INTEGRITY AND SEALING

CONTACT OUR TEAM

REACH OUT TO OUR SUSTAINABLE SYSTEMS SUPPORT TEAM TO LEARN MORE ABOUT OUR UNDERFLOOR AIR SERVICES.

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sustainable@priceindustries.com

Applications Support

Price is a service oriented company and has a dedicated UFAD applications team devoted to answering your questions quickly, completely and accurately. We are here to help. Our applications team regularly provides support on:

- Model Selection
- Layout Assistance
- Calculation Assistance
- On-site Training
- On-site Performance Validation

Price Commissioning Service

Price offers an industry-leading commissioning service, through which our trained Applications team will travel to the installation site and perform some or all the following valuable services:

- Pre-construction meetings
- Construction site walk-throughs
- Installation examples
- Controls integration assistance
- Commissioning assistance of all Price UFAD equipment, including functional testing
- On-site product review and troubleshooting
- Training and education for owner, occupants, and maintenance personnel

Using Price's complete UFAD systems in conjunction with our commissioning service is a great way to **ensure absolute confidence in your Price UFAD system.**

