



Technical and application guide

# Switchgear plenum SafeGear<sup>®</sup> and SafeGear HD<sup>®</sup>

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# Plenum overview

## Why is a plenum required for SafeGear and SafeGear HD applications?

The plenum is integral to the arc resistant design of the SafeGear and SafeGear HD switchgear products. It is an exhaust system as referenced in IEEE C37.20.1 and is required to assure that all the byproducts of an arc fault in the switchgear are channeled away from the equipment and personnel areas and exhausted in a safe location. The plenum is critical to the protection of operations personnel from the arc blast itself, and from falling particles of molten metal, as well as from the superheated air, plasma and toxic gasses produced during the arc fault. This enhanced level of protection eliminates the need for operations personnel to evacuate the switchgear room immediately after the fault to escape the expanding gasses.

SafeGear and SafeGear HD cannot be supplied without a plenum, as it is a critical part of the overall design to achieve the arc-resistant qualification and certification of the equipment.

## How does the SafeGear and SafeGear HD plenum relate to the requirements of IEEE std. C37.20.7-2007: IEEE Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults?

Per IEEE C37.20.7-2007: The user should take into consideration the possibility of the emission of significant arc gases from the equipment in the event of an internal fault. Adequate provisions for dealing with these byproducts must be considered.

ABB addresses this with the arc plenum for SafeGear and SafeGear HD switchgear to assure that all the arc gases and other byproducts are vented outside of the equipment area. As the gases and other byproducts are composed of molten metal and other particles such as epoxy and polyester from paints and insulation, removing these from the equipment area enhances the level of safety for operators.

Per IEEE C37.20.7-2007 section 5.1.1: When the equipment is to be installed indoors or if it is for outdoor installation and has protected-aisle or walk-in provisions, the test arrangement should simulate room conditions in a manner that enables the manufacturer to provide application guidelines that consider the following:

- Distance to adjacent walls
- Ceiling height
- Any obstruction located near the equipment that may deflect hot gas into an area defined by the accessibility type
- Any openings beneath the equipment (e.g., for a cable vault) that may allow hot gas to escape into an area defined by the accessibility type



IEEE C37.20.7-2007 section 5.1.1 also states: If the design incorporates an exhaust system that will vent pressure directly out of the room, no room simulation is necessary.

Because ABB incorporates arc exhaust plenum into its SafeGear and SafeGear HD designs, each potential installation situation does not have to be simulated or tested to determine the effectiveness of the arc resistant protection. Furthermore, each installation of SafeGear and SafeGear HD utilizes the plenum to contain and remove the pressure, arc gases and byproducts thereby safeguarding all surrounding equipment and the installation building itself from damage resultant to the arcing event.

ABB's SafeGear and SafeGear HD can be installed in most building designs, including power distribution centers or E-house type constructions.

# Plenum details

## How much does the plenum weigh?

### SafeGear

- Plenum extension - 24" = 144 lbs (65kg)
- Plenum extension - 36" = 194 lbs (88kg)
- Plenum exhaust assembly = 241lbs (109kg)

### SafeGear HD

- Plenum extension - 24" = 200 lbs (91kg)
- Plenum extension - 36" = 250 lbs (114kg)
- Plenum exhaust assembly = 225 lbs (102kg)

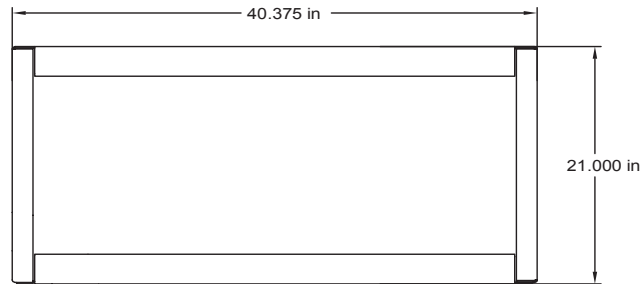
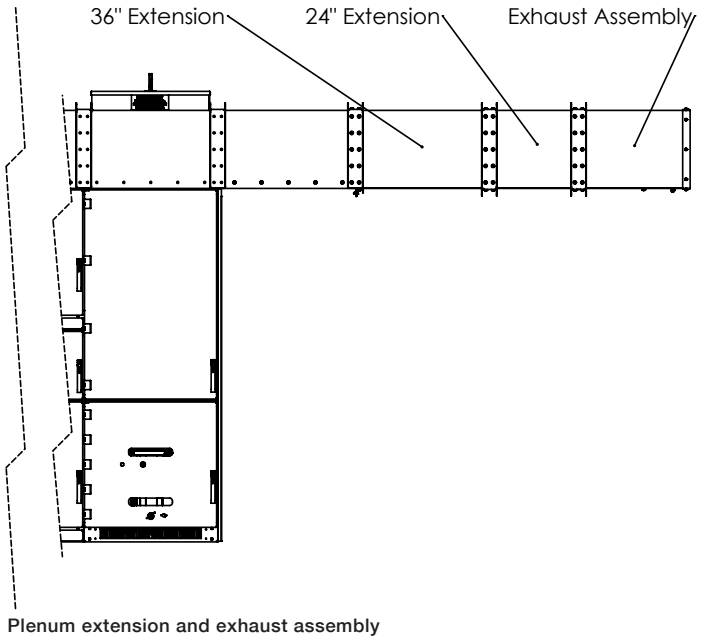
## What is the wall thickness and finish of the plenum?

- SafeGear: MSG No.11 steel.\* Interior sections painted ANSI 61; exterior sections ANSI 70
- SafeGear HD: MSG No.12 steel.\* Interior sections painted ANSI 61; exterior sections ANSI 70

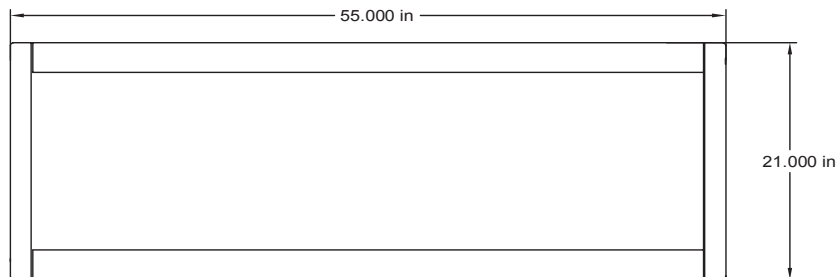
\*SafeGear employs plenum with greater wall thicknesses than SafeGear HD due to reduced cross-sectional area of the plenum opening.

## Is there any flexibility in the sizes in plenums?

Decreasing the cross-sectional dimensions of the plenum is not allowed. The plenum was design tested as sized. Any change in plenum size must be approved by ABB engineering and may require design type testing.



SafeGear



SafeGear HD

Plenum cross section dimensions

# Plenum details

## What is the purpose of the handle on top of the plenum?

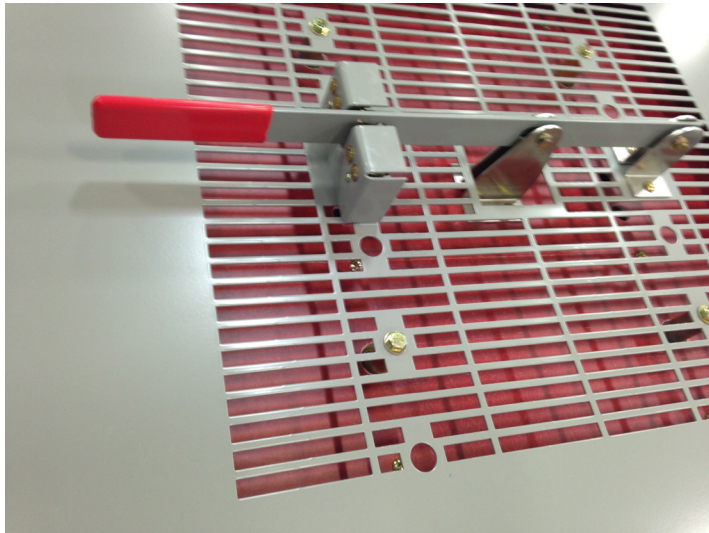
Lineups with 2000 A, 3000 A, or 4000 A main bus and breakers include a spring-loaded, top-mounted ventilation assembly on top of the plenum. These vents are open during normal operation. The vent closes automatically when an arc fault occurs to prevent gasses from entering the switchgear room. The vent can be manually reset from the exterior of the switchgear without the need for de-energization. The handle should be in the down position under normal conditions to provide ventilation.

## Is the plenum weather resistant?

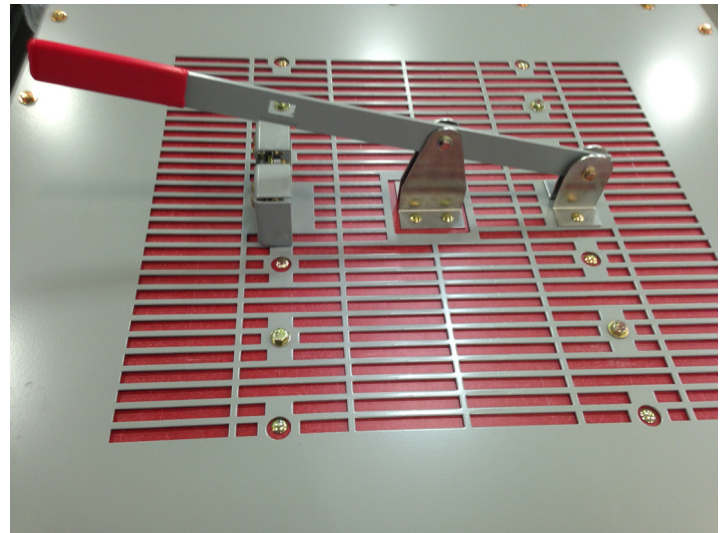
All exterior sections of plenum (those with ANSI 70 finish) are weather resistant. The exhaust assembly includes a weep hole to drain any ingress of water from the atmosphere. The louvered end of the exhaust is closed under normal conditions. The louvered end opens due to the differential pressure caused by an arc event. A protective screen is also installed on the outside of the exhaust assembly to prevent incursion of objects or rodents into the plenum.

In cold weather installations, positive pressure from the cooling of the switchgear through the plenum, along with space heaters located in the exhaust assembly, block the ingress of cold air from outside, as well as the formation of ice on the exhaust assembly which could affect its functionality.

Vent in open position



Vent in closed position



# Site requirements

## What is the minimum installed ceiling clearance for the plenum?

Ceiling clearance is dependent on the lineup rating for both SafeGear and SafeGear HD.

- For switchgear ratings of 1200 A: Minimum clearance above the switchgear (H in the illustration below) = 24". Minimum installed ceiling height = 119"
- For switchgear ratings of 2000 A, 3000 A, or 4000 A: Minimum clearance above the switchgear (H in the illustration below) = 40". Minimum installed ceiling height = 135"

**Note:** Additional overhead clearances will be required for installation. See Installation and Maintenance section for more information on installation.

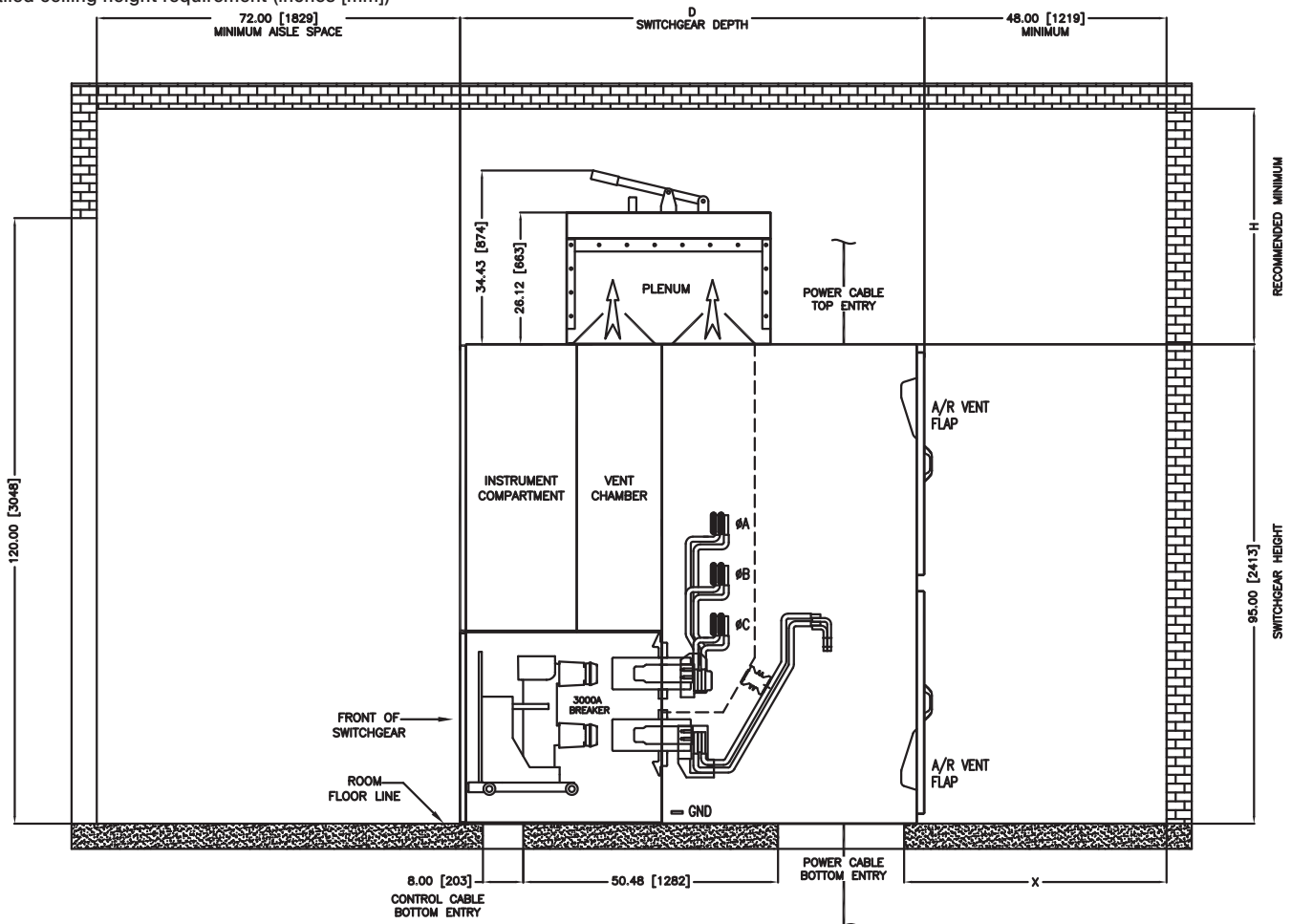
## What is the maximum wall thickness at the plenum exhaust?

The maximum permissible wall thickness at the plenum exhaust is 13.5 inches where the plenum penetrates the exterior wall for standard configurations. Walls with thicknesses greater than 13.5 inches can be accommodated by a custom plenum extension section. These plenum sections will be custom designed to meet the specific project requirements.

## What is the minimum clearance required above the plenum ventilation reset handle?

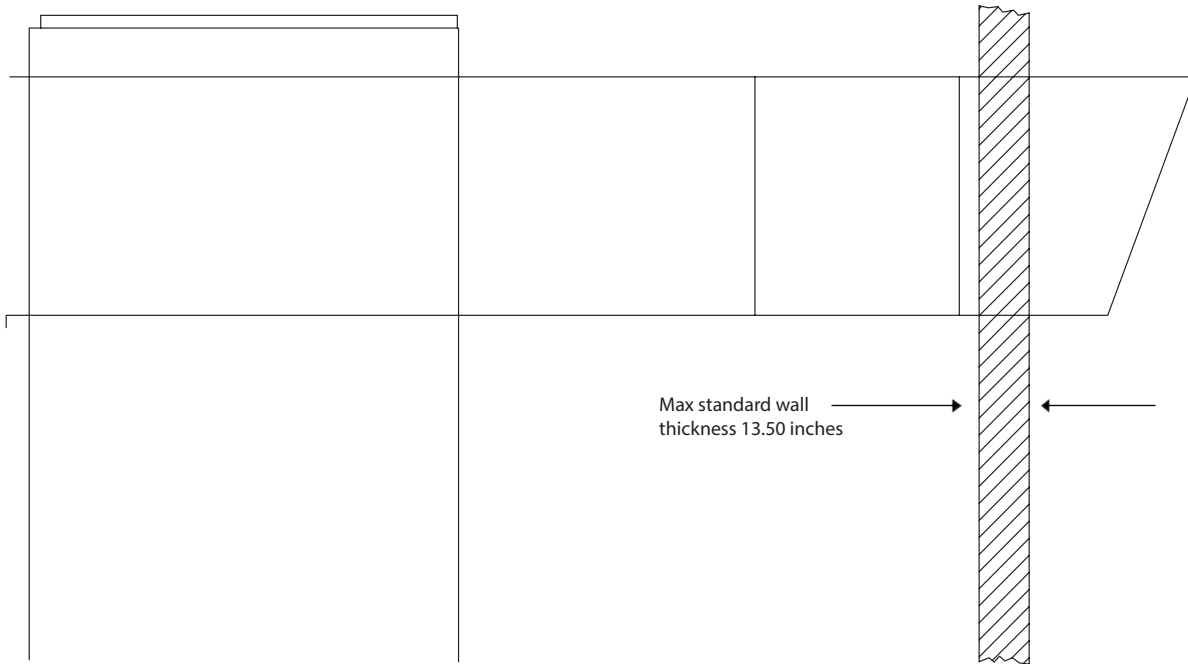
A minimum clearance of 5 inches above the plenum ventilation reset handle (in the up/closed position) is required for all installations.

Installed ceiling height requirement (inches [mm])



# Site requirements

Wall thickness at plenum exhaust point



## What clearance is required at the plenum exhaust?

All personnel, equipment, and other obstructions must remain clear of an 8' diameter area extending 15' from the plenum exhaust point. The area below this exhaust cone must remain restricted to personnel access.

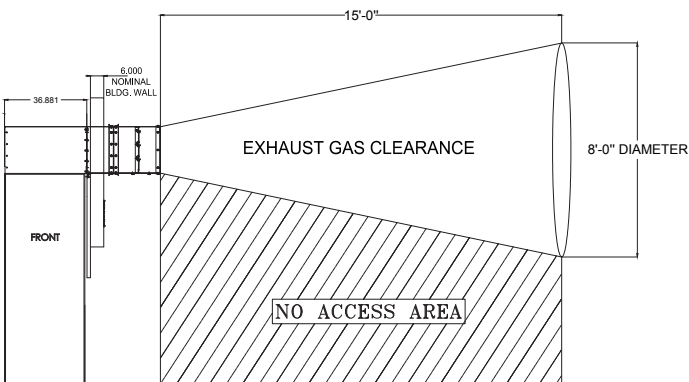
## What are the temperature ratings for the plenum?

The plenum is rated in conjunction with the switchgear for temperatures between  $-30^{\circ}\text{C}$  and  $+40^{\circ}\text{C}$  as dictated by the applicable ANSI/IEEE standards. For applications with temperatures outside of the normal service conditions, as prescribed by ANSI/IEEE C37.20.2, consult your ABB representative.

## Can the plenum be installed in a Class I Division 2 or Class II Division 2 environment?

A Class I Division 2 environment is one in which flammable gasses and/or vapors are possible, but not likely to exist under normal conditions. A Class II Division 2 environment is one in which combustible dusts are possible, but are not likely to exist under normal conditions. For installations in a Class I Division 2 or Class II Division 2 environments contact your ABB representative to determine the appropriate design for the application.

Plenum exhaust clearance



Plenum exhaust during arc event



# Routing

## **Does the plenum have to run left or right from the switchgear?**

The plenum can be directed to the right, left or rear of the switchgear depending on site requirements. Multiple exhaust outlets are allowed but not required.

## **Can the plenum be run vertically?**

The plenum can be run vertically, if necessary, but must terminate horizontally or downward to prevent ingress of precipitation and debris into the plenum via the exhaust assembly. It is not recommended to penetrate the ceiling/roof of the installation building in order to ensure a weatherproof design.

## **Is there a maximum plenum length?**

There is no maximum plenum length, but the plenum must terminate outside the building with the appropriate exhaust clearance.

## **Are bends permitted in the plenum?**

Different routing configurations may be permissible. Any special configurations must be designed and approved by ABB engineering.

## **Can the plenum be shared/combined by different switchgear lineups at some common point prior to exiting the building?**

Yes, the plenum can be combined with different SafeGear or SafeGear HD lineups or with Medium Voltage Motor Control

Centers (MVMCC's). However, due to the pressure and temperature of the gasses generated during an arc fault, damage to the combined plenum and/or equipment may occur as arc fault contaminants may propagate from one piece of connected equipment to another. All plenum connections must be designed by ABB.

## **Can bus or wiring be run through the plenum?**

No. The exception being space heaters in the exhaust assembly for low temperature applications. For these types of applications, space heaters are installed internally, within the plenum, near the exhaust flap assembly with controls mounted near the internal building wall for access.



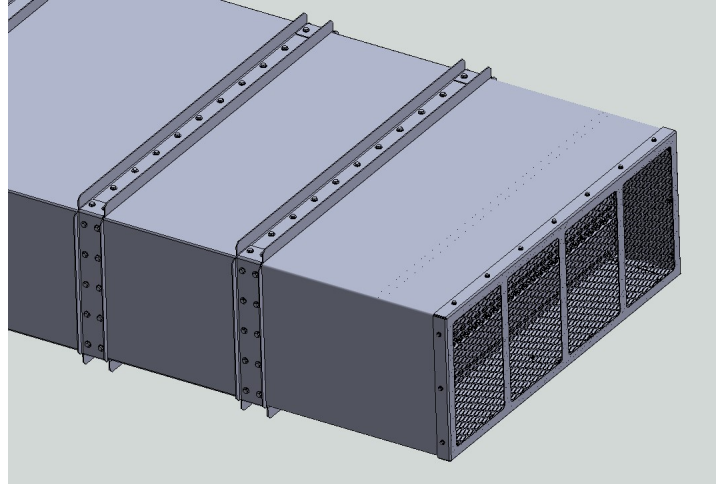
# Installation and maintenance

## Can fewer bolts be used in the plenum joints?

No, the bolts ensure the structural integrity and seal of the plenum assembly.

## What maintenance is required for the plenum?

The plenum and exhaust vent assembly must remain free and clear of obstructions and debris that would prevent the exhaust gasses from traveling, uninhibited, through and out of the plenum. The plenum coating should remain free of chips and other blemishes that may lead to corrosion. Visual inspection of the plenum and exhaust vent assembly is recommended during normal maintenance intervals when the equipment is de-energized.



Plenum joint detail

# Installation and maintenance

## Is the plenum shipped installed on the switchgear?

The plenum is shipped separately and is installed after the switchgear is in place. A three-inch high plenum base is left on top of the switchgear when shipped. The plenum sections are design for external fastening for ease of installation.

## What external support structure is required for the plenum?

Plenum runs with lengths exceeding 6 feet will require permanent structures either above or below the plenum to support load bearing requirements in accordance with local building codes. All plenum support structures are to be designed and installed by the customer's subcontractors.

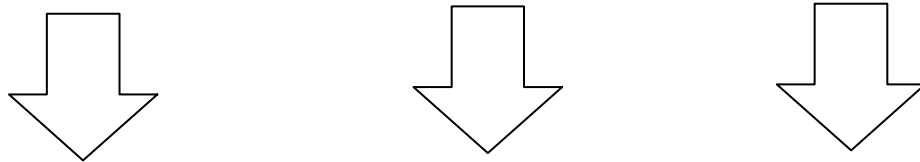
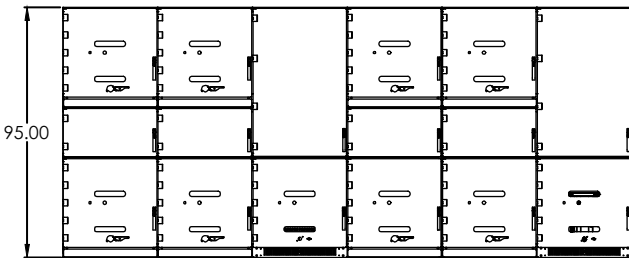
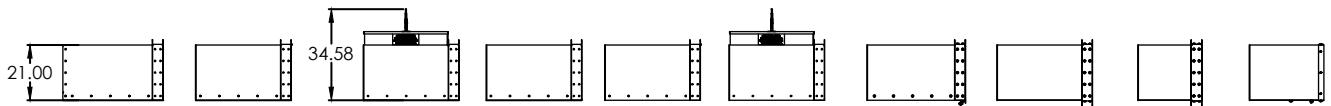
**Note:** Attachment of support structures to the plenum cannot penetrate or alter the plenum construction.

## For vertical sections of plenum, what external support structure is required?

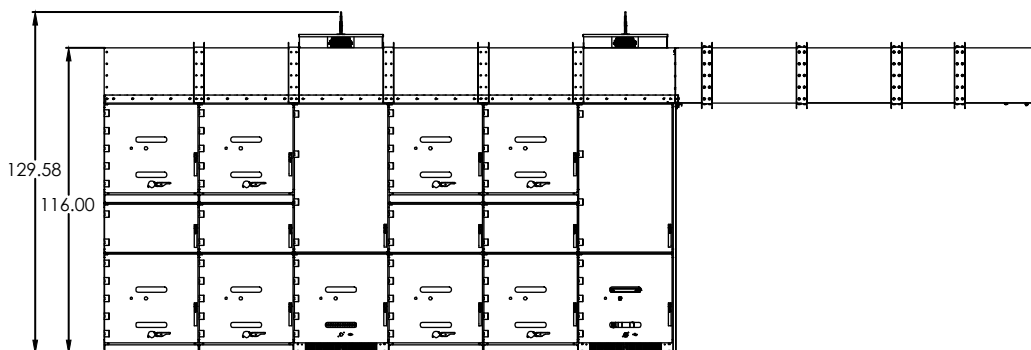
Supports for vertical sections and other non-typical routing configurations are determined on a case-by-case basis and must be in accordance with local building codes. All plenum support structures are to be designed and installed by the customer's subcontractors.

1 Plenum assembly as shipped | 2 Plenum assembly installed (3" base does not add to the 21" plenum height)

1



2



# Notes

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