



Save time, space, and lower installed cost on MEP support applications

Eric Grant

Contractor Sales Manager
B-Line series solutions
Eaton, Highland, IL, USA

20 plus years of field and sales experience working with the Electrical, Mechanical, Plumbing and Fire Protection trades

Overview

How to improve flexibility; maximize space while lowering total installed cost of supports in electrical, mechanical, and plumbing (MEP) facility-subsystems

In order to be competitive in today's challenging market, it's important to leverage support solutions that provide flexibility, maximize space and lower total installed cost.

In this white paper, we will be addressing some of the biggest challenges facing owners, designers and installers today, supporting systems.

Factors that impact job installation time, cost and complexity

There are several factors that drive installation time, cost and complexity. Let's look at these items individually, to see how they impact job installation time and cost.

1) Space limitations and structural obstructions

Often when trying to find space for mounting items such as piping, duct, electrical conduits, cable trays, data cabling and equipment, the contractor must deal with shrinking cubic areas. Obstructions to attachment due to structure type or other architectural features can limit locations and/or increase the frequency of connections.

Limitations due to architectural design and a simultaneous increase in the complexity of systems commonly leave the contractor with fewer options. Building Information Management (BIM) modeling has aided in the coordination efforts; however, space is still at a premium. The fact remains that getting systems from one place to another is proving more difficult than ever.

2) Frequency of supports and load

Specifications, as well as guidelines and standards contained within the applicable building codes, often determine maximum support spacing. Care must be taken to help ensure the application of the specification does not conflict with the loading capabilities of the chosen products. There are instances that could occur where the specification may not fully address the loading of the supports or could lack the appropriate guidance regarding structural connections. These instances may require the contractor to increase the frequency of supports or change to a different structural connection.

While the design of the support itself is critical, the attachment to the structure can often limit the methods chosen as well as spacing of the supports.

To develop the proper design of the support, it is important to consider the desired spans between supports based on the applied loads anticipated and the connections available.

The responsibility to determine the correct loading calculation has shifted to the contractor in recent years. Design build and assist has become the norm for building delivery systems. This requires more focus on the design and submission to the Engineer of Record, and is paramount to the process.



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3) Product selection

Now more than ever, labor impact as well as product capabilities must enter into the equation. The total installed cost of a product now determines a products' long term success in the marketplace.

Traditional strut configurations typically only allow support from the continuous slot side of strut channels. This can cause the number of strut channels and need for back-to-back strut to increase, thus driving cost up.

When considering low carbon steel strut channels, there are a variety of finishes and material types. The job site conditions will determine the material and finish required.

- Pre-galvanized is the most common finish and can be cost effective.
- Stainless steel type 304 and 316 material can provide increased levels of corrosion resistance and cleanliness in many applications.
- Dura Green™ coating process is considered a superior solution over pre-galvanized for corrosion resistance and better paint adhesion for exposed ceilings. It is also ideal for Data Center applications, where zinc - whiskers can be foreseen as an issue.



4Dimension strut with dove tail bar shows back-to-back solution.



4Dimension strut with cable tray and universal pipe clamps.

4) Labor costs

Coordination is one of the most important considerations contractors have to make once the overall project scope has been determined. Deciding which product to use is a balancing act between performance and budget constraint. Cost of a product alone can no longer serve as the major focus.

Depending on the project configuration, labor can be up to 70% of the cost of mechanical, electrical and plumbing (MEP) systems. Coordination and product selection can assist in helping cut labor costs, while helping drive value for the contractor and ultimately the owner.

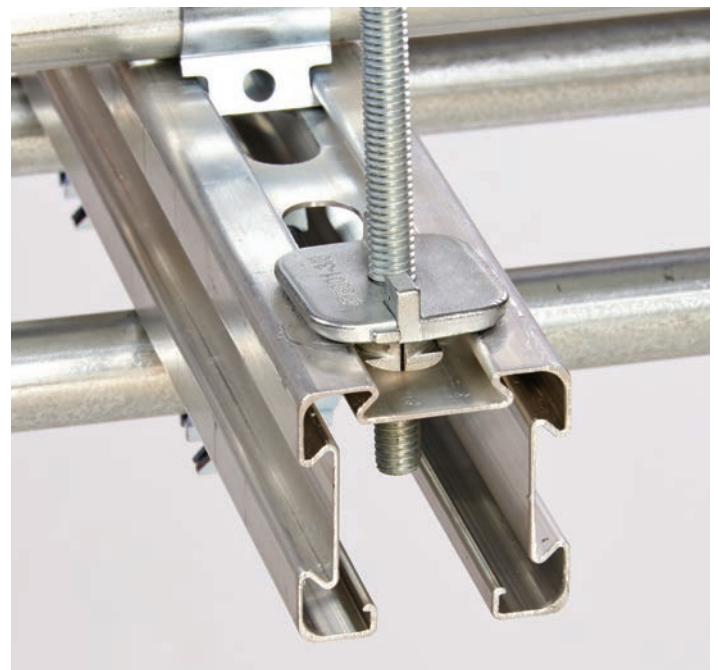
Product selection is critical to minimize the impact on job installation time, cost and complexity

Strut channels are selected based on uniform loading or column loading needs. First, the support spacing minimums need to be determined based on specifications and guidelines. Then the actual calculated loads must be determined.

With the contractor now armed with the calculations and the specifications for the project, the product selected for the application can greatly impact the need to reduce or increase the distance between supports.

Uniform loading of a strut channel is determined by the span between the hanger rods or distance between vertical members (floor stands) and the number and/or weight of the supported items. Reducing the span between vertical members can significantly improve the uniform loading capacities of the strut channel members.

Let's review two case studies on the next page that provide insight on how product selection can impact the job installation time, cost and complexity.



4Dimension strut with turn and lock trapeze hanger.

Traditional strut system versus Eaton's B-Line series 4Dimension strut system

The case studies shown below are actual projects where a customer chose to use 4Dimension™ strut over traditional strut and realized significant savings. While these two cases are some of the most common applications, the lessons learned here can be applied to many other projects. For more information on how you can save on your next project, please contact your local Eaton representative.

Case study #1: Traditional strut vs. Eaton's B-Line series 4Dimension strut 4D22

Project example: A quantity of (8) 4" schedule 40 steel pipes filled with water weighs 130.4 lbs. per foot. If the supports are at a span of 10', this would be up to 1,304 lbs. per support.

Traditional strut solution

Using traditional strut channels, the maximum support uniform load capacity at 48" long would be 851 lbs. with .224" of allowable deflection. Using traditional strut would not work with these parameters; so spacing would need to be reduced to 6' 6" to accommodate the load. To avoid the reduced spacing, the contractor would need to change the configuration to back-to-back traditional strut channel. This would double the cost of the solution, may increase lead-time, and could significantly increase the overall installation cost.

Eaton's B-Line series 4Dimension strut solution

By using Eaton's B-Line series 4Dimension strut (4D22), the contractor can elect to utilize the multi-sided functionality and mount pipe over and under the channel. This will result in a 24" long strut channel versus the traditional 48" long strut channel; thus reducing the material cost up to 55%. If compared to welded back to back 1½" channel, the 4D22 also reduces the vertical space taken by 1½". This 24" long 4D22 strut channel has the load capacity of 1872 lbs. with .10" of deflection; therefore, allowing the distance between supports to be the planned 10'.

A huge benefit is the ability to work on the entire trapeze from one location because the trapeze is half as long. This saves the installer trips up and down ladders or adjusting lift locations. The installer may even reduce rental costs by reducing the number of man lifts required to perform the work.

4Dimension cuts up to 10 x's faster due to material thickness, which can also reduce cost of cutting materials (ie.: saw blades).

Case study #2: Traditional strut vs Eaton's B-Line series 4Dimension strut 4D21

Project example: An electrical contractor has to mount (8) ¾" EMT conduits and (8) 1" EMT conduits on a rack for branch circuits.

Traditional strut solution

The total length of the trapeze rack using Eaton B-Line series B22SH would be 24". The total load of the conduits can be up to 18 lbs. per foot at a 7' span the total load per support would be 126 lbs. The load rating for the strut channel is 1,702 lbs. far exceeding the requirement.

Eaton's B-Line series 4Dimension strut solution

By using Eaton's B-Line series 4Dimension strut (4D21), the contractor can elect to utilize the multi-sided functionality and EMT conduit over and under the channel. This allowed the contractor to reduce to a 12 inch trapeze length, while maintaining an acceptable load rating of 1,402 lbs. This reduced the cost by reducing the length of the channel required.

By using the B-Line series 4Dimension turn & lock or Flip Clip™ with the 4Dimension strut installers can save up to 70% on labor cost vs. traditional hex nut and flat fitting installation methods.

The ability to shrink the length of the trapezes, and easily coordinate the total footprint of the pathways for conduit and piping runs, can have dramatic positive results in very tight installations.

A huge benefit is the ability to work on the entire trapeze from one location because the trapeze is half as long. This saves the installer trips up and down ladders or adjusting lift locations. The installer may even reduce rental costs by reducing the number of man lifts required to perform the work.

4Dimension cuts up to 10 x's faster due to material thickness, which can also reduce cost of cutting materials (ie.: saw blades).

Below is a simple calculator tool devised to show installed cost savings. To learn more, visit eaton.com/4Dimension or contact your local Eaton representative.

Installed method type	Strut strength: uniform load (lbs.)*	Installed cost % savings
48 inch - 1 ½" Strut	851	
48 inch - 4D21 Strut with Flip Clip	351	42.43%
48 inch - 4D21 Strut with turn lock	351	39.47%
24 inch - 4D21 Strut with Flip Clip	700	52.82%
24 inch - 4D21 Strut with turn lock	700	46.76%
48 inch - 4D22 Strut with Flip Clip	936	35.34%
36 inch - 4D22 Strut with turn lock	936	27.33%
18 inch - 4D22 Strut with Flip Clip	1872	49.45%
18 inch - 4D22 Strut with turn lock	1872	42.71%
Load rating of ¾" Flip Clip pair (lbs.)	770	
Load rating of turn lock pair (lbs.)	1155	

Bill of Material reference**

Traditional strut & accessories:

- 1½" strut
- ¾" ATR (threaded rod)
- Hex nut
- Square washer
- Lock washer

4Dimension strut & accessories:

- 4D21 or 4D22 strut
- ATR (threaded rod)
- ¾" Flip Clip or Turn and Lock trapeze hangers

* For slotted hole (SH) use 90% of Strut strength

** Information on chart is based on Bill of Material (BOM) shown above

Conclusion

With Eaton's B-Line series 4Dimension™ strut system, owners, designers and contractors have an opportunity to save time and material, as well as lowering their overall total installed cost.

1) Space limitations and structural obstructions

- The 4Dimension strut system provides solutions to solve space limitations and structural obstructions.
- The multi-sided functionality of 4Dimension strut drives flexibility and space saving opportunities.
- When using 4Dimension strut as a substitute for traditional back-to-back strut, the overall height of the channel is reduced. The 4D21 channel is 5/8" shorter than traditional 5/8" channel.
- 4Dimension dove-tail bar creates an option to build instant back-to-back or side-by-side; the options are virtually limitless.

2) Frequency of supports and load

- The multi-sided 4Dimension strut system (4D22 or 4D21) offers the flexibility of a back-to-back system with the strength and cost similar to a single sided traditional strut system. By using 4D21 or 4D22 strut, the user now has the ability to mount items over and under the channel, thus reducing the length of the strut required. A shorter channel has a higher uniform load capacity, as shown in Case Study #1, which allows a greater support span without the added cost of back-to-back channel.
- 4Dimension has a higher strength to weight ratio than traditional strut. For example, 4D22 has 10% higher uniform load rating than 12 ga. 1 5/8" traditional channel.
- Higher loads can be achieved easily in the field by using one of the back-to-back options shown in the catalog. Using dual dovetail channel nut accessory with two 4Dimension channels has the same load rating as traditional back-to-back welded channel.

3) Product selection

- 4Dimension strut is available in pre-galvanized, hot galvanized dip, DuraGreen™, stainless steel 304 and 316.
- The system works with 2 1/2" diameter and smaller, which is up to 80% of pipe installed in a commercial structure.
- It is compatible with up to 90% of current traditional strut fittings.
- Its multi-sided design makes 4Dimension strut an ideal solution for new construction as well as retrofit and for future expansion. It is also compatible with jobs currently using traditional strut and fittings.
- The unique profile and multi-sided functionality coupled with innovative time saving accessories, makes the 4Dimension strut system an ideal solution for most common day to day applications, and even speciality applications.

4) Labor costs

- If applications and codes allow, the coordination of trades and the use of 4Dimension strut can significantly reduce the installation time and cost. For example, a duct installer may combine with the plumbing and mechanical piping supports to significantly reduce installation time and material cost. The multi-sided functionality of the 4Dimension system allows mechanical, electrical and plumbing applications to use the same supports.
- 4Dimension strut includes innovative trapeze hanger designs that allows for quicker installation and labor savings.
 - The Flip Clip™ hanger, (as shown in Case Study #2), for 4Dimension strut reduces the number of components to install from nine (9) components - (4 hex-nuts and 4 flat fittings plus the strut channel) down to five (5) components - (2 hex-nuts and 2 Flip Clip hanger plus the strut channel).
 - The 4Dimension turn and lock hanger reduces the total number of components from 9 (4 hex-nuts and 4 flat fittings plus the strut channel) down to 3 (2 turn and lock hangers plus the strut channel) and offers a 1/4 turn application.
- 4Dimension system design allows for options to be pre-fabricated, which can be easier to lift and secure into place and help speed installation.
- The 4Dimension system has up to a 10 x faster cutting speed due to material thickness, and easy to field fabricate into back-to-back applications as required.

With 4Dimension strut system, owners, designers and contractors now have the product that will help minimize total installed cost, helping the users be more competitive and ultimately more profitable.

To learn more, visit eaton.com/4Dimension.

To request support, visit cooperblineline.com/contactus.

About Eaton

Eaton's electrical business is a global leader with expertise in power distribution and circuit protection; backup power protection; control and automation; lighting and security; structural solutions and wiring devices; solutions for harsh and hazardous environments; and engineering services. Eaton is positioned through its global solutions to answer today's most critical electrical power management challenges.

Eaton is a power management company with 2015 sales of \$20.9 billion. Eaton provides energy-efficient solutions that help our customers effectively manage electrical, hydraulic and mechanical power more efficiently, safely and sustainably. Eaton has approximately 97,000 employees and sells products to customers in more than 175 countries.

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