

Sales Engineering Technical Paper Series

Aluminum vs. Hot-Dipped Galvanized Tray – “The Aluminum Advantage”

Aluminum cable trays offer many advantages over steel cable tray. Aluminum has a high strength-to-weight ratio, is an extremely good electrical conductor, offers corrosion resistance in most service conditions, and is much easier to install than steel cable trays.

A high strength-to-weight ratio is one of aluminum’s most useful characteristics. For example, compare two cable trays of similar strength with a 7 in. side rail height, 24 in. width, and 20-foot length. The aluminum tray, B-Line Series H47, can support 149 lbs/ft on a 20-foot span and weighs 4.54 lbs/ft. The steel tray, B-Line Series 574, can support 130 lbs/ft on a 20-foot span and weighs 7.30 lbs/ft. In other words, an aluminum tray that supports a heavier load weighs only 60% as much as the steel tray. Because of the high strength-to-weight ratio and the extrusion process, aluminum cable trays can be constructed of great strength, and still be light enough to easily handle during installation. B-Line’s strongest 7” aluminum tray can support 95 lbs/ft on a 25-foot span. Compare this to B-Line’s strongest steel tray, which supports only 90 lbs/ft on a 24-foot span.

Cooper B-Line also manufactures long-span aluminum cable trays that can be supported on 30, and even 40-foot spans. As discussed previously, the high strength-to-weight ratio and extrusion process used to make aluminum side rails allows us to construct trays long enough to span roadways or bridges.

FYI: Keep in mind that it is important to consider environmental loads when using long span trays.

Lets take a look at the two B-Line long span trays, both having a 6 in. load depth, and 24 in. width. B-Lines series 57A, can support 75 lbs/ft on a 30-foot span, and 108 lbs/ft on a 25-foot span, and weighs 5.69 lbs/ft. Series S8A can support 173 lbs/ft on a 30-foot span, and 77 lbs/ft on a 40-foot span, and weighs 7.82 lbs/ft. Not only do both of these trays exceed the maximum span length and load capacities of steel trays, but also they are much easier to work with. 57A also remains much lighter than the steel tray in question, while S8A slightly exceeds the weight of the steel.

Aluminum cable tray has excellent electrical conductivity for use as an equipment-grounding conductor (EGC). Aluminum trays are adequate for circuits with ground-fault protection up to 2000 amperes, while steel is only acceptable for ground-fault protection up to 600 amperes. Aluminum’s superior current carrying capacity eliminates the need to purchase and install a separate EGC (in qualifying industrial installations) and increases the safety of the installation by providing a better fault current path. Below the area requirements for cable trays used as equipment grounding conductors are shown as required by Article 318 of the 1999 National Electric Code.

Table 318-7(b) (2)
Metal Area Requirements for Cable Trays
Used as Equipment Grounding Conductors

Maximum Fuse Ampere Rating, Circuit Breaker Ampere Trip Setting, or Circuit Breaker Protective Relay Ampere Trip Setting for Ground Fault Protection of any Cable Circuit in the Cable Tray System	Minimum Cross-Sectional Area of Metal* In Square Inches	
	Steel Cable Trays	Aluminum Cable Trays
60	0.20	0.20
100	0.40	0.20
200	0.70	0.20
400	1.00	0.40
600	1.50**	0.40
1000	--	0.60
1200	--	1.00
1600	--	1.50
2000	--	2.00**

For SI units: one square inch = 645 square millimeters.

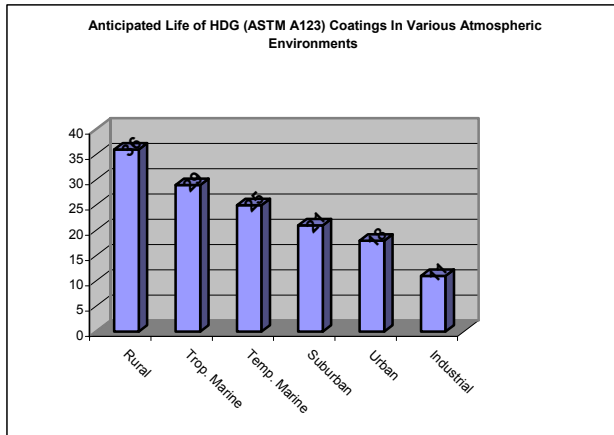
* Total cross-sectional area of both side rails for ladder or trough-type cable trays; or the minimum cross-sectional area of metal in channel-type cable trays or cable trays of one-piece construction.

** Steel cable trays shall not be used as equipment grounding conductors for circuits with ground-fault protection above 600 amperes. Aluminum cable trays shall not be used as equipment grounding conductors for circuits with ground-fault protection above 2000 amperes.

For larger ampere ratings an additional grounding conductor must be used.

The corrosive resistance of aluminum is another beneficial characteristic. In moderate environments, aluminum cable trays can perform for 30 to 40 years, making it ideal for many chemical or marine environments. B-Line manufactures cable tray of the aluminum alloy 6063-T6. This alloy is copper-free and is sometimes referred to as marine grade aluminum. Although the aluminum may experience some chloride pitting in a marine environment, the corrosion does not affect the structural integrity of the system. In fact, the 6000 series aluminum alloys have been recommended by the American Petroleum Institute for offshore oil platforms. Aluminum out-performs steel in corrosive environments due to its method of protection. When aluminum surfaces are exposed to the atmosphere, they immediately form a thin oxide film to protect the metal from further oxidation. Since aluminum is a homogeneous material, the oxide film immediately repairs itself at all cuts and scratches. This offers a great advantage over steel, as zinc coatings must be repaired with a zinc rich paint at all cut surfaces. At each point of repair, the zinc coating is inferior to the original galvanizing, and leaves a flaw in the steel’s armor against corrosion. Since the galvanizing on steel trays is designed to slowly wear away as it protects the steel, this can prematurely end the product’s service life. Figure 1 illustrates the anticipated service life of Hot-Dipped Galvanized (ASTM A123) cable trays.

Figure 1

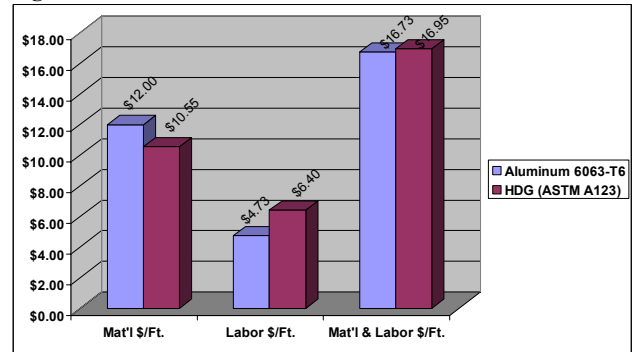


* Service life is defined as the time to 5% rusting of the steel surface.

Aluminum cable tray has a distinct strength advantage over steel cable tray in very cold environments. As temperature decreases, low carbon steel products will lose ductility slowly until a certain point where the ductility suddenly decreases by over 50%. This point is called the ductile/brittle transition and occurs in all unalloyed, low carbon steel. Depending upon the quality of the steel, the transition can occur anywhere from +32 degrees F to -40 degrees F. These temperatures are hardly arctic but are low enough to require steel cable tray to be over designed by 20 to 50% to compensate for the decreased ductility, especially on long spans. This adds substantial weight and expense to an already heavy system. Aluminum, fiberglass and 300 series stainless steels maintain a much greater ductility in low temperatures and would only require a minor (10%) increase in design strength making either a much better choice in cold climates.

The largest benefit of using aluminum cable tray over steel is ease of installation. Since aluminum cable trays are much easier to cut, punch, and drill, field cuts require less time. Also, there is no need to apply a protective coating on the exposed edges of the aluminum, as is required with galvanized steel. The weight difference of the trays also has a significant impact on the installation. For instance, a 20 ft length of tray discussed above weighs approximately 90.8 lbs. in aluminum and 146 lbs. in steel. Since the aluminum weighs approximately half as much as the steel, it may require only half as many laborers to install the tray. This would provide significant savings in the cost of the project and shorten the installation time. Figure 2 illustrates the difference in material cost, labor cost, and total cost of the two materials as provided by R.S. Means.

Figure 2



*Information provide by R.S. Means

**Labor information based off a two-man crew installing 4" x 24" cable tray at an elevation of 15-feet.

Not only is there an obvious savings in overall installation costs, but there is also an average increase in daily output. The average output of a two-man crew for aluminum tray is approximately 116-feet per 8-hour day. The same crew using Hot-Dipped Galvanized tray would average a daily output of 86-feet. Let's put together an example based off the cost and output information so we can see the actual installation difference.

Example) Based off the previous information provided, let's determine our total cost and total amount of time spent on the job if installing 1000 linear feet of aluminum and Hot-Dipped Cable tray.

	Mat'l	Labor	Total	Installation (Days)
Aluminum	\$12,000.00	\$4,730.00	\$16,730.00	8.62
Hot-Dipped	\$10,550.00	\$6,400.00	\$16,950.00	11.63

Based off the information provided, it is easy to see that Aluminum is the better choice. Although material cost may be approximately 4% higher for aluminum, it is easy to make up that difference in labor and daily output. These are also very conservative numbers, as R.S. Means has to cover the bases of all cable tray manufacturers. I can assure you that you will see a larger savings in labor cost using B-Line products than shown above. This is attributed to B-Line's wedge lock splice configuration. This splice is standard for all Aluminum trays, and when being installed locks into the tray side rail. This will aid the installer in hoisting the tray as well as lining up the splice holes. Because of its locking configuration, this splice plate needs only four bolts, compared to most eight-bolt splice plates provided by other manufacturers. This will directly effect output and labor costs by cutting the amount of bolts to be tightened in half.

When selecting the proper cable tray for your project, it is important to consider all factors, and not just initial material costs. If material costs alone was considered aluminum tray would never be used. But if all factors, material, labor, and total installation time is considered we can see that aluminum is the obvious choice. Not only will the overall project cost be less, but also the total time on the job would be reduced. Reduction in project length may allow time for additional projects to be accepted, resulting in more work and income. All of this information is important, because in today's economy two hundred dollars could be the difference in winning or losing a project bid.