

# Faster, cheaper, safer data center construction products

## Jellybeans.

That's the slightly derogatory term that Dave Sterlace sometimes hears applied to the many small pieces and parts that are part of every construction project, including data centers.

"Connectors, fasteners, lugs ... they are all jellybeans to some people," said Dave Sterlace, marketing development manager – data centers and critical power at Thomas & Betts, a member of the ABB Group. "But think about the tens of thousands of those small parts that are used in a project, and consider that every one of them has to be attached, tightened or twisted. Selecting the right components can make a tremendous difference in how quickly your crews can complete the job."

Small innovations in these small components can deliver big results, not only in the speed and cost of the job, but also in the quality of the finished data-center infrastructure.

### Grounding

Exothermic welding has long been the gold standard for grounding connections. The molten metal created in the reaction permanently and completely joins the conductors. For new data center construction, where connections are made before the building is closed in, having a pot of materials burning at 1,400 Celsius with the accompanying smoke, fumes and sparks doesn't present a particular fire or health risk. For expansion or repair of existing structures where connections are made indoors, the fire and heat of exothermic welding can be an issue.

While the exothermic process unquestionably produces a high-quality attachment point for the grounding cable, that connection requires a complex set of steps, multiple components, molds that wear out and consumables in addition to the starting powder and welding material. Additionally, making a quality connection is dependent on the skill of the tradesman.



A safer, more convenient alternative that provides a comparable-quality ground connection use 30 tons of pressure to compress and bond the grounding cables. Presses used for this process are full-cycle, meaning that once the tradesman initiates the process, the press will complete the full compression cycle, ensuring a solid connection.

This is not a recent innovation. The compression method has been used for decades. Still, some consultant engineers and construction managers are unsure about the quality of the resulting connection and have therefore been slow to spec it on jobs.

“We’ve cut some of these compressed joints apart to check the integrity,” said Sterlace. “When you crush copper-stranded cables under that much pressure, all the air gap between strands disappears. You get total surface-to-surface grounding contact.”

Using the compression method is significantly faster, simpler and cleaner. The connector costs are comparable, and the cost of the press can be quickly recouped from the time and material savings.

### Power Connections

They say that the devil is in the details. In a data center, those devils can hide in the tens of thousands of power connections. Anything that can be done to ensure the integrity of those connections will help prevent power issues and avoid tedious and time-consuming efforts to track down the source of a power problem.

One potential problem point is the wire-to-lug connection. Imperfect connections have gaps between the cable and lug.

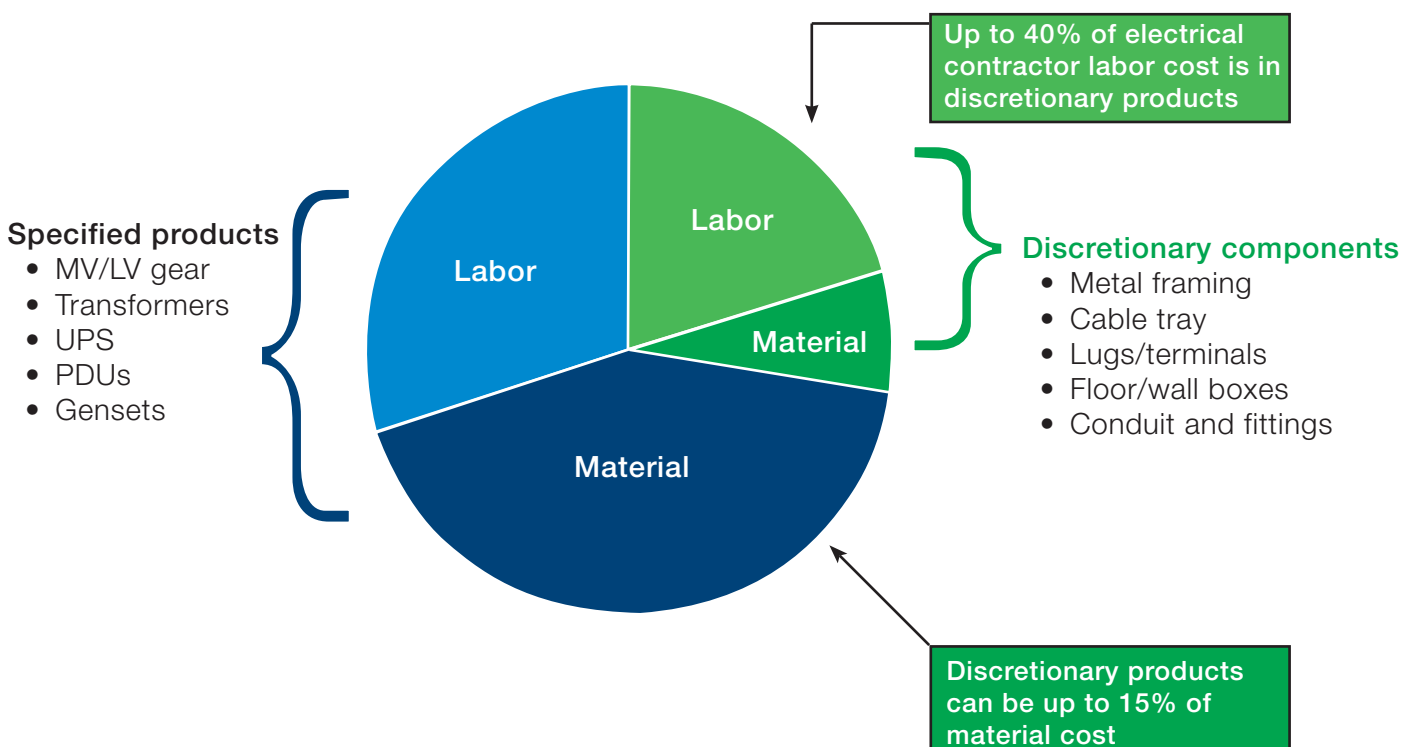
Each of those gaps can create a hot spot that could result in a short circuit or fire.

“An essential element of making good connections is a proper match between lug and tool,” Sterlace explained. “One way to accomplish this is by selecting a color-coded system that ensures the electrician consistently uses the right die and lug combination. With this system, even less-skilled construction crew members can be counted on to make correct connections. It’s as easy as matching the color of the compression tool die to the color of the lug.”

To further ensure high integrity connections, electricians can select compression tools and lugs providing a superior crimp. Traditional methods create the well-known crushed-C-profile crimp. Instead, electricians can select lugs that crush the connection from all sides, creating a hexagonal shape with more uniform contact. These tools are available manually operated, but for the big jobs like data centers, cordless battery-operated and hydraulic versions are all available.

Possibly one of the simplest components on a data-center-construction job is the lowly washer. Even here, it’s worth thinking about the part selected.

“Some people use a nut, bolt and split locking washer to create connections,” said Sterlace. “For about the same



money, they could use a Bellville washer. Look inside most switchgear, and you will discover this is the washer of choice for OEMs. They know it provides a superior connection and doesn't damage the copper. "

### Cable Trays

Cable tray could be considered a commodity item. It comes in stock lengths that are easily and quickly cut to the required size. But this is another area where smart facility architects and design engineers can significantly reduce installation costs while achieving a more functional facility. New technologies, like BIM (building information modeling), allow designers to layout their cable tray needs ahead of time in a fully attributed 3D model of the data center, and allow the option of prefabrication.

"Instead of cutting down long lengths of cable tray, you can source prefabricated tray that arrives on site in the required section lengths," explained Sterlace. "By eliminating all the measuring, cutting and fitting, you save quite a bit of time. An added benefit of the prefabricated tray is it installs more easily. It's a one-handed job."

In addition to straight tray runs, there are also standard curves and corners available. These components really shine when compared to that traditional approach of notching and bending a straight piece of tray to create a curve. Not only does prefab save time, it also provides an edge-free surface that is less likely to damage cables. The radii were chosen in accordance with wire and fiber optic cable industry bending standards to remove concerns about that as well. Because the tray arrives finished from the factory, there's no concern about zinc whiskers or metal shavings flaking off at the cut edges and falling into the equipment below.

"There's also the issue of tray grounding," Sterlace added. "The pre-cut tray and prefabricated radius pieces include tabs that interlock between components to provide grounding. When installers use cut tray sections on corners, they have to add grounding wire."

Even the tray-hanging hardware offers an opportunity to cut construction time while adding future functionality. Most trays are suspended from very long lengths of threaded rod. Running nuts up and down these rods is tedious and time consuming. A faster alternative to traditional nuts are trap

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nuts, simple devices that clamp at the desired point on the threaded rod. During initial installation, trap nuts can reduce nut placement time by 80%. They also make it possible to easily install new trays between the current tray and the ceiling, because there's no need to run a nut up from the bottom of the rod.

### Summary

New data centers continue to be built and old centers are routinely refreshed with new hardware. Both activities entail construction efforts. On the typical project, costs are evenly divided between labor and materials. On the materials side, about 15% of the spend is for "jellybeans," the small components generally considered to be commodity items. But up to 40% of the contractor's labor costs are related to installing those components. Saving even a fraction of a minute on the installation of each of these tens of thousands of pieces of hardware will slowly add up to a significant labor cost reduction.

When planning a data-center-construction project, most attention is focused on the major milestones and large assets. It also makes sense to spend some time considering the literal nuts and bolts of the project. Doing so can reduce costs, shave the project timeline and create a more reliable and functional facility.

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