

## Contractors enjoy sweet savings from small parts



Today's data center is a monument to magnitude. Extending hundreds of thousands of square feet, filled with tens of thousands of servers, streaming petabytes of data and consuming dozens of megawatts of power, the data center is all about building bigger and broader capabilities. Without an array of very *small* components, however, it would just be a building filled with lifeless copper, aluminum, steel and silicon.

Some contractors group these connectors, mounts, supports and other little pieces as “small parts.” Others call them “jellybeans,” because they’re perceived as small, multi-colored components that come in different flavors but otherwise are pretty similar. They frequently are seen as commodities that can be scooped up by the shovelful from any supplier to get the center built rapidly and cheaply.

However, contractors who overlook the differences between standard components and those that are smartly designed with easier assembly and greater cost savings in mind may find their bids to be increasingly uncompetitive. Thomas & Betts ABB (T&B) was a pioneer in developing better small components that collectively can make a huge difference in costs for data centers. These items are categorized in construction budgets as discretionary components, after labor and materials. They include metal framing, cable trays, floor and wall boxes, lugs, terminals, conduit and fittings.

Dave Sterlace, data center and critical power market development manager for T&B, cites industry figures showing that up to 40 percent of electrical contractor labor costs on a data center is in discretionary products. Additionally, these components can comprise as much as 15 percent of the project’s materials costs.

“When looking at hundreds of miles of cables, all of which need to be connected to equipment or to each other, we can begin to understand the impact that more efficient small components can have on a project’s schedule and budget,” Sterlace says.

The savings are especially noticeable in four aspects of electrical contracting work: computer modeling, prefabbing, grounding systems and component design.

### Computer modeling

The most successful data center contractors insist on using building information modeling (BIM), a 4D computer simulation technology that creates a virtual model of the entire data center infrastructure, with details down to the location and type of every connector and terminal. BIM is especially valuable when designing cable tray systems.

“In a traditional computer-aided design (CAD) model, a cable tray is depicted as a rectangular tube, resembling a ladder lying on its side,” Sterlace says, “but T&B has advanced this design technology. Now we can show precisely where the ‘rungs’ of the ladder are—where each set of cables needs to drop down.”

### Prefabbing

This modeling capability can be combined with prefabbed cable tray that requires no cutting or measuring on the job. Instead of trimming down 10- or 20-foot lengths of conventional material, T&B produces its own cable tray in the lengths specified by the BIM model. At the same time, the contractor will need trapeze mounts and connectors to support the tray, and T&B provides those small parts through a partner supplier so that everything is delivered to the right place at the right time. All the electrical pieces required to complete a job in one portion of the project could actually be placed on a cart and moved to that spot overnight so that workers have everything they need at their fingertips in the morning. With labor costs averaging around \$200 per hour, this simple preparation, based on detailed preplanning, can dramatically reduce installation costs.

### Grounding systems

Wiring throughout the data center must be grounded in a number of areas. Grounding is called for when working with raised floors, attaching wiring to building steel, or grounding equipment in a ring around the entire building, so that all the equipment remains at the same reference voltage.

Usually contractors build a grounding grid using exothermic welding—a somewhat crude process in this day of digital precision and clean rooms. Exothermic welds are designed to bond two ground wires together in a neck with a mold fitted over them. The process uses powdered copper and gunpowder. The contractor lights a fire that sets off the charge, which welds the pieces together.

Unfortunately, it’s not immediately apparent if the exothermic weld has created a good connection. It works most of the time, but this is a chemical process that depends on humidity levels and the skill of the worker. It’s much more an art than a science. Further, it’s expensive and the molds wear out in an uneven manner.

“When an existing data center is being upgraded, no one wants to light fires and set off gunpowder inside a data center, nor wait for just the right humidity levels to arise,” Sterlace observes. “So T&B came up with a compression grounding system that squeezes the wires together instead of welding them. We developed a tool that carries out the compression and that embosses a symbol onto the wires to indicate that a good crimp has been produced. Success is not dependent on the skill of the operator. Even a journeyman electrician can achieve a flawless crimp every time with this tool.”

Major contractors now are telling their clients that they will only use the compression method for grounding.



Construction products from Thomas & Betts. Construction products include grounding, bonding and connections, framing and cable support.

### Component design

Thomas & Betts invented the color-coded connector 60 years ago and has worked throughout the decades since then to develop innovative types of connectors that further reduce labor and material costs. For example, when running generators, data centers use thick power cables that are difficult to bend. Today, contractors can employ extra-flexible cable called diesel locomotive only (DLO), or welding cable, in locations where high levels of vibration occur or more complex bending is required. Thomas & Betts has created a connector that can accept both types of cables in the same lug and provide complete integrity. Fewer parts are required, and the installation time is reduced.

Another clever component from Thomas & Betts is an ingenious trapnut, a hinged, split nut that simply clamps over a threaded rod. Using the trapnut in place of a standard nut on a 15-foot threaded rod will slash labor cost for the job by 82 percent.

### A big future for small parts

“We’re continuing to make big plans for the small parts of the future,” says Sterlace. “One opportunity would involve integrating heat sensors within lugs so that the lug knows of an overheating problem even before the circuit breaker does and can trip the breaker before any damage occurs. Another would entail ‘smart bolts’ that connect sections of switchgear and that would detect the torque that has been applied, as well as any overheating. Rather than manually examining all the bolts, operators could simply ‘ask’ the bolts if they are getting too warm.”

The scale and speed of data center construction demand that contractors stay abreast of all the technology that can be used. And that means paying attention not only to large, critical pieces of equipment but also to the small stuff—what’s inside the walls, floors and ceilings of the data center. The savings those jelly beans may produce can leave a sweet taste in the mouth of any budget-minded contractor.

For more information please contact:

#### ABB Data Centers

12040 Regency Parkway  
Cary, NC 27518  
Phone: +1 800 HELP 365  
[www.abb.com/datacenters](http://www.abb.com/datacenters)

[www.abb.com](http://www.abb.com)

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