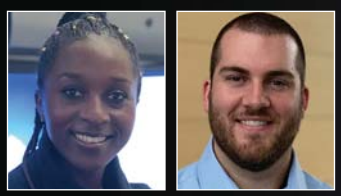
JULY 2023
ecmweb.com

THE MAGAZINE OF ELECTRICAL DESIGN,
CONSTRUCTION AND MAINTENANCE

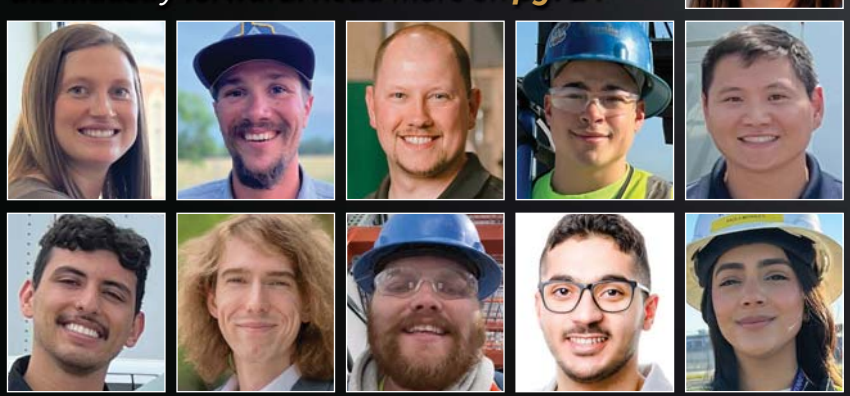
EC&M®



30 Under 30

EC&M ALL STARS

An inside look at how these young electrical professionals are driving best practices, investing in training/technology, and moving the industry forward. Read more on ***pg. 24***



IN THIS ISSUE

American Pros Use American-Made Steel Conduit

Atkore™
Allied Tube & Conduit

Saluting a workforce that will never quit.

For over 60 years, our American-made products* have helped American workers get the job done. And get it done right. Because with an unbreakable domestic supply chain and the highest quality EMT, IMC and GRC steel conduit providing the foundation, Atkore – Allied Tube & Conduit and the rock-solid American workforce will never stop building better together.

Learn more at alliedeg.us

Slotted Aluminum Rails

Cut how you need it and shipped fast

Sure frame™

NEW!

Additional Fath Hardware Available Including Workstation Components

NO CUT FEES, EVER!
CUT TO YOUR SPECIFICATION AND DELIVERED TO YOU IN 2-DAYS!

Sureframe	AutomationDirect	V/S. McMaster-Carr	80/20	Framing Tech
77" (4) 1.5" x 3" light weight	$277.20 1530CL	$415.80 4706ST809	$348.36 1530-LS	$349.08 1.5X3.0/240INCH
34.5" (4) 1.5" x 3" light weight	$124.20 1530CL	$186.30 4706ST809	$163.06 1530-LS	$161.36 1.5X3.0/240INCH
27" (4) 1.5" x 3" light weight	$97.20 1530CL	$145.80 4706ST809	$130.36 1530-LS	$128.24 1.5X3.0/240INCH
Total Extrusion Cost	$498.60	$747.90	$641.78	$638.68
Cut Charge	$0.00	Hidden in pricing	$3.16/cut	$2.25/cut
2 Day Delivery	$0.00	Unknown upfront, added during billing, 3-4 day only available	$300.38	$389.04
Total Cost	$498.60	$747.90	$942.16	$1,027.72

All prices are U.S. published prices. AutomationDirect prices as of 04/06/2022. Prices and specifications may vary by dealer. McMaster-Carr prices are from https://www.mcmaster.com 2/10/2022. 80/20 prices are from https://8020.net 2/10/2022. Framing Tech prices are from https://www.framingtech.com 2/10/2022. Prices subject to change without notice. Prices for aluminum do fluctuate. Check vendors websites for latest current pricing.

SureFrame T-Slotted Aluminum Rails

SureFrame T-slotted aluminum rails are available in the most popular profiles and dimensions. T-slotted rails are ordered in your custom cut-to-length sections for maximum flexibility and minimum waste.

We also offer a full selection of assembly hardware for T-slotted rail systems, which includes T-nuts, fasteners, connecting components, joining plates and brackets, as well as floor, door and panel elements. SureFrame T-slotted rails, along with the assembly hardware components offered, are compatible with many other brands.

Also Available

- AC variable frequency drives (VFDs)
- Motors
- Wiring and electrical connection solutions
- Just about everything you need to complete your automation projects!

Features

- You specify length and cut angles for each piece
- No cut fees
- Free 2-day delivery on all orders over $49*
- Available in 1 inch, 1.5 inch, 30mm, 40mm and 45mm profiles
- Complete selection of Fath installation hardware available

Research, price, buy at:

www.automationdirect.com/t-slotted-rails

Order Today, Ships Fast!

TOP RATED BY CUSTOMERS

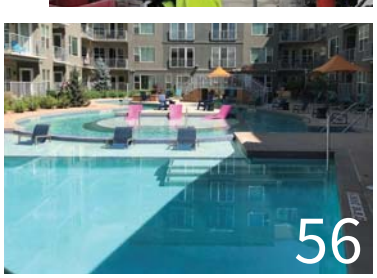
AUTOMATIONDIRECT.com
1-800-633-0405 the #1 value in automation

CONTENTS

COVER STORY

OTHER FEATURES

NATIONAL ELECTRICAL CODE



EC&M®
July 2023 • Volume 122 • Number 7

DEPARTMENTS

The BNT Nonmetallic Cable Support For Power Manholes And Vaults

UNDERGROUND DEVICES
BNT NONMETALLIC CABLE SUPPORTS:

- High Load Capacity
- Arms Can be Used With Nonmetallic or Steel Stanchions
- Will Not Rust or Corrode
- Insulators Not Required
- Excellent Dielectric Properties
- Multiple Stanchion Lengths Available
- Arms Available in Multiple Lengths With Integrated Saddles or a Flat Surface
- Molded from UL Listed Glass Reinforced Polymer

BNT Saddle Arms Installed in a Nonmetallic Stanchion

UNDERGROUND DEVICES
INCORPORATED

420 ACADEMY DRIVE
NORTHBROOK, IL 60062
Phone: 847-205-9000 • Fax: 847-205-9004
Website: www.udevices.com

@ ECMWEB.COM

With its exclusive online content, ecmweb.com is a valuable source of industry insight for electrical professionals. Here's a sample of what you can find on our site right now:

CODE CONVERSATIONS PODCAST — AN AFCI EPIPHANY

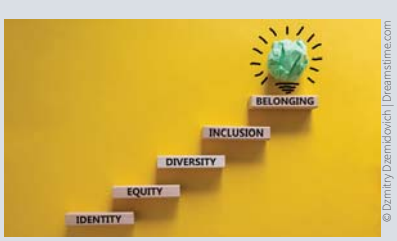
Podcast ▶ In Episode 22, Editor-in-Chief Ellen Parson and Code Consultant Russ LeBlanc dive into AFCI protection requirements.

ecmweb.com/21268725

FIVE WAYS TO REDUCE MAINTENANCE COSTS

Maintenance, Repair & Operations ▶ Electrical Consultant Mark Lamendola shares tips for cutting costs related to maintenance.

ecmweb.com/21268903



ADDRESSING THE CONSTRUCTION INDUSTRY'S DISCRIMINATION ISSUES

Construction ▶ Tom Zind breaks down the EEOC's plan for addressing the sector's perceived employment discrimination history.

ecmweb.com/21268071

EC&M®

Electrical Construction & Maintenance (USPS Permit 499-790 , ISSN 1082-295X print, ISSN 2771-6384 online) is published monthly by Endeavor Business Media, LLC. 1233 Janesville Ave., Fort Atkinson, WI 53538. Periodical postage paid at Fort Atkinson, WI, and additional mailing offices. POSTMASTER: Send address changes to Electrical Construction & Maintenance, PO Box 3257, Northbrook, IL 60065-3257. SUBSCRIPTIONS: Publisher reserves the right to reject non-qualified subscriptions. Subscription prices: U.S. ($68.75 year); Canada/Mexico ($ 112.50); All other countries ($162.50). All subscriptions are payable in U.S. funds. Send subscription inquiries to Electrical Construction & Maintenance, PO Box 3257, Northbrook, IL 60065-3257. Customer service can be reached toll-free at 877-382-9187 or at electricalconstmaint@omeda.com for magazine subscription assistance or questions.

Corporate Office: Endeavor Business Media, LLC, 30 Burton Hills Blvd., Ste 185, Nashville, TN 37215 USA, www.endeavorbusinessmedia.com

MADE IN USA

SP PRODUCTS, INC.

Productivity and value thru ideas

FOR SAFER BETTER FASTER JOBS

We're Proud to be the Electricians' Friend for Over 50 Years!

Qwik Duct

Safer Better Faster

Save on Installation!

IP3b

Patent Pending

PVC Offset

Sizes 1/2" thru 6"

Meets Flexible Mandrel Test Requirements

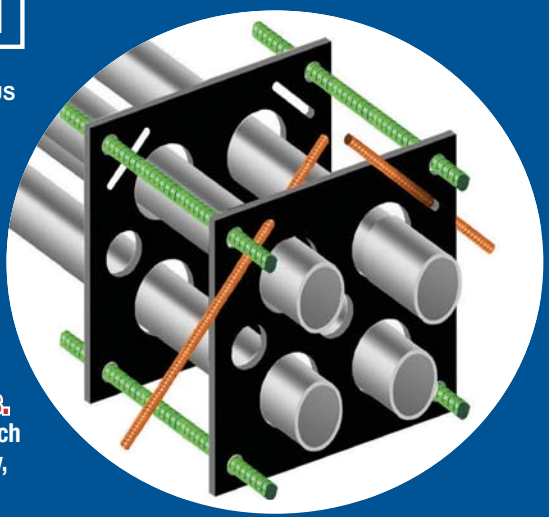
HDPE CUSTOM TEMPLATES

In Any Configuration Required

IP1

c UL us

Patent Pending



Bore Spacers **IP2**

Sizes 1/2" thru 6"

Roll assembled conduit into caissons and under obstructions

c UL us

Assemble Conduit Above Trench-

No Workers Below - Prevents Injuries and Deaths.

Also Allows Digging a Narrower Trench for Less: Excavation, Concrete, Slurry, Backfill & Shoring.

IP13A-F

Conduit Transition Couplings

c UL us

PVC Schedule 40 & 80

Transitions in Less Than

5 Minutes

PATENT PENDING

IP15

End Bell Adapter

Schedule 40/80 PVC

c UL us

PATENT PENDING

Save Cost on the Rigid Nipple, Tape & Labor

Use for Entire Job - Not Just for Repair

IP15

1 Piece Reaming Bit

1/2" thru 6"

Schedule 40/80

Plus More Being Invented for **SAFER BETTER FASTER** *Jobs . . . Call With Your Ideas!*

SPProducts.com **800-233-8595** info@SPProducts.com

Ensuring the Electrical Industry Legacy Not Only Stays Alive But Also Thrives

By Ellen Parson, Editor-in-Chief

The ongoing labor shortage that continues to plague the electrical industry is real. It's not a surprise or a secret, and it's not improving at a rapid pace — it's basically just the new reality our *EC&M* audience has to live with. Whether you're an electrical contractor, consulting engineer, or a plant facility engineer/technician, I'm sure you've felt the struggle at least to some degree. Workers are leaving the industry at a much faster clip than they can be recruited, replaced, and retained. Take electricians as an example. According to the U.S. Bureau of Labor Statistics, employment of electricians is projected to grow 7% from 2021 to 2031, which equals almost 80,000 openings per year for the next decade. These openings not only stem from people pursuing careers in other industries but also to those retiring. Pew Research Center reports nearly 29 million Baby Boomers retired in 2020, and 75 million are expected to leave the workforce by 2030, paving the way for what is now being characterized as "The Great Retirement."

Every year, respondents to our Top 50 electrical contractors and Top 40 electrical design firms surveys reveal issues with worker shortages. "Difficulty finding and retaining quality employees" has also topped their list of factors that have the most negative impact on business the last several years, even trumping supply chain problems and economic conditions/inflation. Despite these challenges, *EC&M* readers continue to devise and implement innovative strategies to bridge the labor gap, such as mentorship programs that match new employees with veteran workers; on-the-job training and shadowing initiatives; recruiting retired engineers/contractors to work with the younger generation; documenting veteran work practices in training materials; matching new hires with mid-level electrical professionals during training sessions; inviting experienced workers to offer leadership training to younger employees; and creating intergenerational teams to work together.

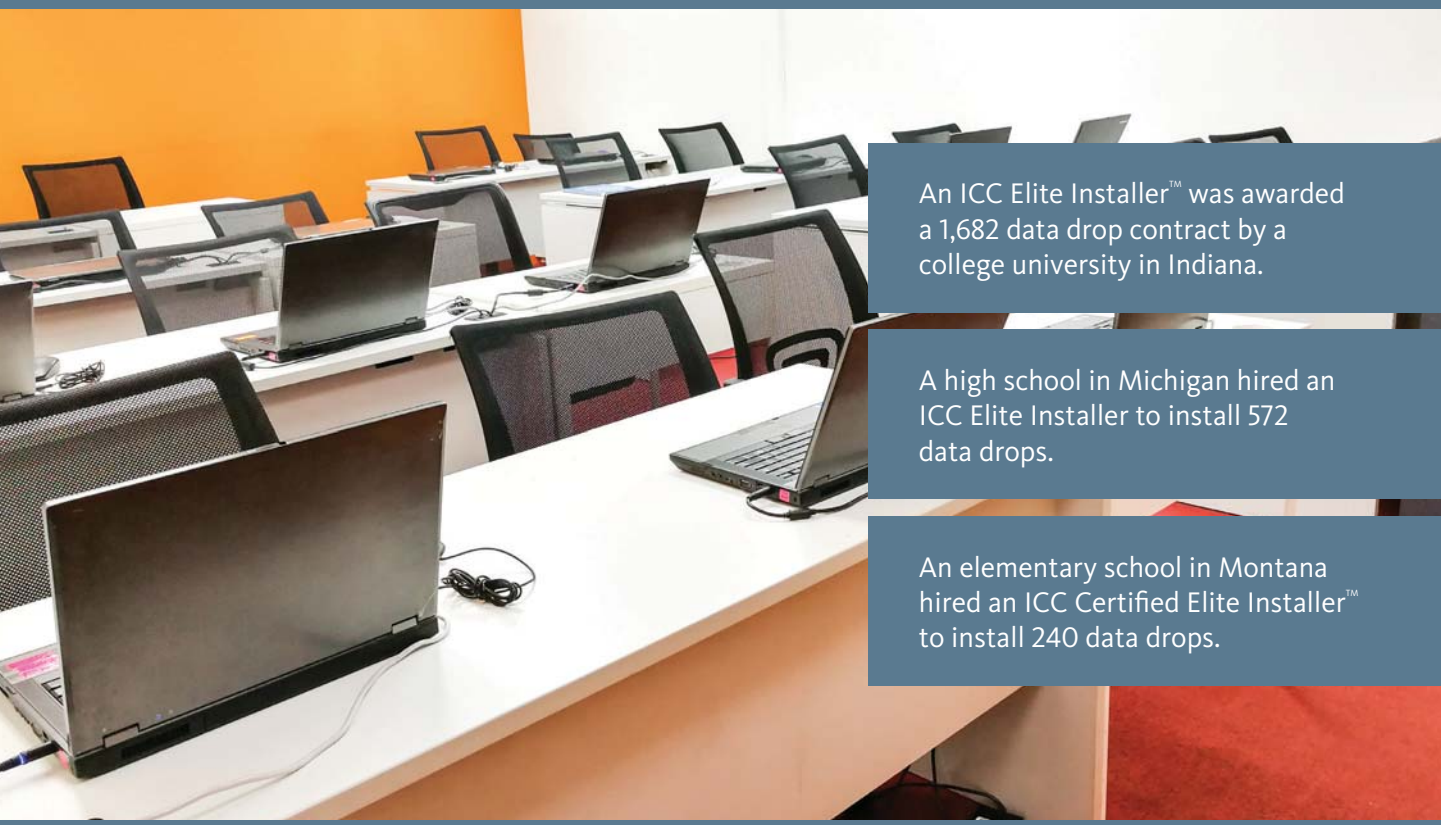
Featured in my latest *EC&M* On Air podcast (in honor of Father's Day), father and son duo Bruce Clodfelter, Sr. and Bruce Clodfelter, Jr. of Rosendin Electric exemplify this exact type of thinking outside the box, which makes me confident the electrical industry will not only stay alive but also thrive in the future. Nearing retirement after working at the same electrical contracting firm for his entire career (34 years), Bruce, Sr. was convinced by his son, Bruce, Jr. (who is vice president of field operations at Rosendin) to take a leap of faith and join the Rosendin team. It's common for electrical work to run in families or be passed down to the next generation, but this story puts a twist on passing the torch. "My son came by my house one day and asked me what I thought about coming over to Rosendin," said Bruce, Sr. "I asked him if he needed a glass of water — maybe the heat was getting to him or something. I thought about it for a week or so, and then he came back again — he's very persistent that way. I decided, yeah, why not? Life begins at the end of your comfort zone, so why not try something different and new. I also was really looking forward to working alongside my son again but in a different capacity." Listen to the full podcast at https://rb.gy/jb80j.

Bruce, Jr.'s unconventional idea proved to be an undeniable success. When it comes to mentoring, what insight did Bruce, Sr. possess that clicked so easily with his younger peers? "When he came on board, I think it was just his overall knowledge and years of experience," said Bruce, Jr. "Yes, he was new to Rosendin, but he was definitely not new to the trade. When he would speak, people immediately realized there was something they could gain here. Yes, there's knowledge but also experience that backs that knowledge. It's not just having that presence, but also the patience — being able to pause a moment and listen to where people are coming from and then bringing that experience back to the table."

It's people like the Clodfelters that continue to inspire and motivate the next generation in this industry. And speaking of innovative young electrical professionals, this year's group of 30 Under 30 Electrical All Stars, featured in the cover story starting on page 24 and written by Freelance Writer Amy Fischbach, is a testament to the bright future of this industry. In this special report, read the personal journeys of 30 individuals who are innovating best practices, investing in training and technology, and moving the industry forward.

Ellen Parson

Are You Winning School's Cabling Project Bids?

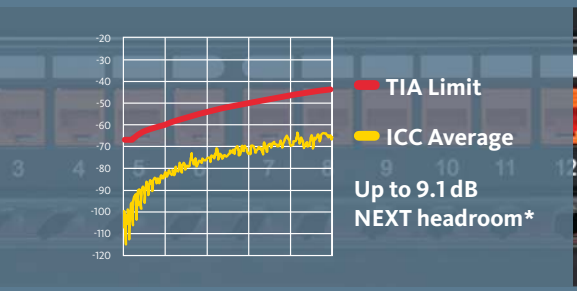


An ICC Elite Installer™ was awarded a 1,682 data drop contract by a college university in Indiana.

A high school in Michigan hired an ICC Elite Installer to install 572 data drops.

An elementary school in Montana hired an ICC Certified Elite Installer™ to install 240 data drops.

Schools have trusted ICC for over three decades to meet their data cabling requirements. Our **CAT 6A** Connectors are 40% less expensive than the big brands while beating them in performance and reliability. ICC's data cabling solutions help schools stay within budget and help installers increase their margins - a win-win situation for all! If you're tired of losing bids using the big brands, it's time to switch to ICC. Visit icc.com/success to learn more.



We only sell through distribution partners; we have hundreds of distributors nationwide who would love to have your business. Find them on icc.com/distributor or contact us at cs@icc.com.

ICC

icc.com cs@icc.com

TARGET DISTRIBUTING	TELEDYNAMICS	Beach wire and cable	JENNE	Coleman's TELECOM	fontel
Maryland	Texas	California	Ohio	Utah	Nebraska
888.792.7463	800.847.5629	800.309.2322	800.422.6191	801.484.5238	800.238.0787

Premise Cables · Workstation Outlets · Patch Panels · RCM · Fiber Optics · Residential Enclosures

*When installed and tested with ICC CAT 6A premise cable and connectors, in accordance with TIA permanent link specification.

The Language of Estimating

Twenty terms every estimator should understand

By Don Kiper, Estimating 101

Every aspect of life seems to have its own language. From construction to medicine to computers, all industries have jargon that is unique and must be understood. Language is communicated with words and phrases. To understand, you must know the meaning of some keywords. For example, pilots have the "aviation phonetic alphabet," which allows them to clearly communicate with the air traffic controller. If a pilot fails to clearly communicate with the tower, tragedy may follow.

Likewise, the estimator must understand the meaning of key concepts of the estimating process to properly perform his or her job.

I contend that estimating is 100% science. Any portion of the process you may consider an "art" has very little impact on the outcome. Guessing the amount of time it takes to hoist a generator to the roof is different than guessing what is in the scope of work and what is not. And if you run your estimating department by "gut feeling," a bad feeling may be just ahead. I think you get the idea.

Following are 20 important terms every estimator must understand:

1. Scope of work — The scope typically will define drawings and spec sections, and it may include a list of responsibilities for the contractor. This usually is defined in the specifications. If there is no scope of work given to the contractor, the contractor must provide a detailed list of items included in the bid price.

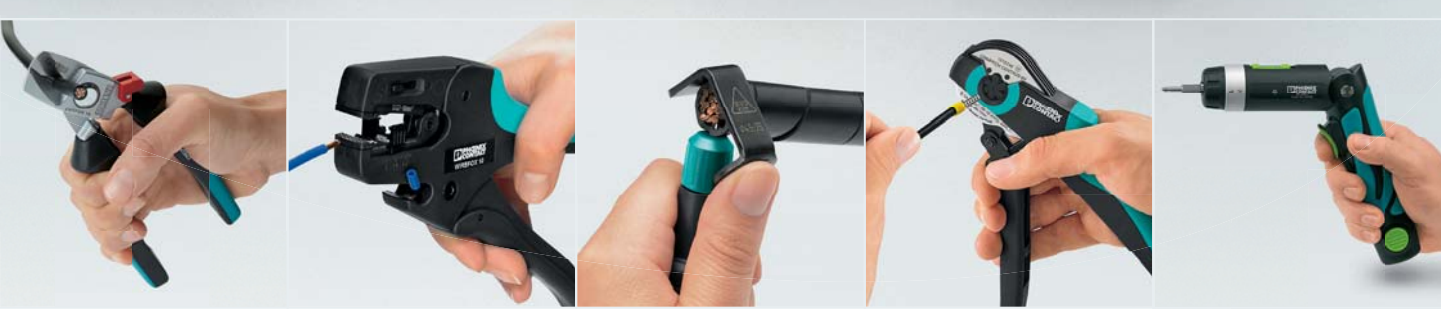
2. Project schedule — The number of days or weeks determined by the start date and completion date of the project. A project schedule will affect the crew size. The larger the crew size, the greater the negative impact on productivity.

3. Project phasing — A phasing schedule typically will identify areas or portions of the work that need to be completed in a chronological sequence. A phasing schedule may require the contractor to demobilize and re-mobilize these areas.

4. Addendum — Addendum means "something added." Architects issue addendums to correct design mistakes/changes and add omissions to the contract documents. Cost changes directed by any addendums must be reflected in the contractor's price.

5. Request for information (RFI) — A memo or email submitted to the architect or engineer for clarification related to something in the contract

THE TOOL fox



TOOLS you can TRUST

Partner with the TOOL fox to take advantage of these benefits:

- Robust, durable, and ergonomic industrial wire-processing hand tools
- Cut, strip, and crimp with consistent high-caliber results
- UL Listed when used with Phoenix Contact's quality ferrules
- Backed by a dedicated sales team and technical service
- Covered by a limited lifetime warranty

For more information and videos, please visit
www.phoenixcontact.com/us-TOOLfox.

PHOENIX CONTACT

documents. The RFI can become an estimator's best friend.

6. Bid security — A bid bond or certified check that guarantees that the contractor will sign a contract (if offered) in accordance with his proposal. Failure to enter into a contractual agreement will result in forfeiture of the bid security. For example, a project with a 10% bid security and a bid price of $1,000,000 would result in a $100,000 loss to the contractor.

7. Base bid — The estimated costs for the primary work requested by the customer, often including the scope of work.

8. Alternates — Alternates provide the owner with a choice between different products and construction methods or can define the addition or deletion of a portion of the work. Alternates may be additions or deductions from the base bid, and they provide the owner flexibility when a project has limited funding.

9. Labor unit — The amount of time to install material and/or equipment. The basic standard labor unit is comprised of the following: 65% installation time, 20% material handling, 10% layout, and 5% supervision.

10. The takeoff — A complete list of materials and labor units to install the work. Typically generated with estimating software, this list will provide the estimator with the total material costs and direct labor hours required to install the materials.

11. Feeders — The conduit and conductors or cable between the main service disconnect switch or main switchboard and distribution panels, transformers, motors, and transfer switches.

12. Site power — The conduit and conductors from the local utility source to the main service disconnect switch, main switchboard, or main distribution panel.

13. Installation labor factor — An adjustment of labor units made to specific takeoffs based on the ease or difficulty of the installation. For example, more labor is required to install conduit at 40 ft above the finished floor than installed at 8 ft.

14. Project labor factor — A project condition that will impact labor productivity negatively. There are many project labor factors. The wise estimator will research and learn as many of these as possible. There may be as many as 50 conditions that will cause a project's labor to be impacted negatively. Here are a few to consider: project location, multistory, cold weather, hot weather, occupied premises, and overtime.

15. Allowance — In bidding, money set aside in the contract for items that have not been selected and specified. For example, the owner may not have selected all the lighting fixtures needed and may specify a certain amount of money to be included in the contractor's bid to be used to purchase fixtures selected by the owner.

16. Direct costs — The costs directly attributed to a work scope, such as labor, materials, and subcontracts. It does not include indirect costs like office overhead.

17. Indirect costs — Costs for items and activities not directly related to constructing a structure but are necessary to complete the project (i.e., contractor's overhead expense).

18. Job expenses — These are expenses that are not part of the material costs of the project. This can include depreciation of tools or equipment that are used from job to job, testing, site office/storage trailers, and similar expenses.

19. Overhead — The costs of doing business if you have no projects. Some contractors use a set percentage; others use a dollar amount per labor hour in the estimate. One thing is certain: Overhead should not be viewed the same for all projects.

20. Profit — The return on the investment and risks or funds that remain after all project costs and overhead have been paid. This should be the sole reason that you are in business.

Learning the language of estimating will provide clarity in the process. The product of miscommunication is an inaccurate estimate. The product of an inaccurate estimate is an inaccurate bid price — and an inaccurate bid price may provide the contractor with a net loss on the project. EC&M

Don Kiper is an independent electrical estimating trainer and consultant based in Niagara Falls, N.Y. He can be reached at don@electricalestimating101.com.


YOUR TO-DO LIST CAN BE A LOT.
WE MAKE ONE THING EASY.
See if you can save with Progressive.
EDDIE'S
EXPERT ELECTRICS
Progressive Casualty Ins. Co. Coverage provided and serviced by affiliated and third-party insurers.
As a small business owner, you can't escape your to-do list.
That's why Progressive makes it easy to save with a commercial auto quote, so you can take on all your other to-dos. Get a quote in as little as 6 minutes at ProgressiveCommercial.com
PROGRESSIVE®
COMMERCIAL

A Quick Guide to Discharge Testing

Capacity testing is an effective way to measure battery health.

By Sanket Bolar, Megger

Batteries serve as the main source of power in a substation in the event of an AC outage. They power critical loads and equipment like relays, indicator lamps, circuit-breaker controls, motor operators, SCADA equipment, event recorders, etc. As the battery is truly tested only during an outage, it is important to monitor battery health regularly as part of preventive maintenance so they can be relied upon when the AC power source fails. Capacity testing or discharge testing is an effective way to track battery health and thus ensure reliability.

NERC/FERC REQUIREMENTS

The North American Electric Reliability Corporation (NERC), certified by the Federal Energy Regulatory Commission (FERC) as the Electric Reliability Organization (ERO) in 2006, develops and enforces reliability standards among all bulk power system (BPS) owners. NERC covers stationary battery maintenance procedures in the standard PRC-005-6 to ensure a reliable protection system.

Among other activities, PRC-005-6 states that ohmic testing or capacity testing must be performed at specified intervals that vary depending on battery type (**Table 1**).

Battery Type	Maximum Maintenance Interval for Capacity/Ohmic Testing
Vented lead-acid battery	18 calendar months or 6 calendar years
Valve-regulated lead-acid battery	6 calendar months or 3 calendar years
Nickel-cadmium battery	6 calendar years

Table 1. Maximum recommendedmaintenance interval by battery type.

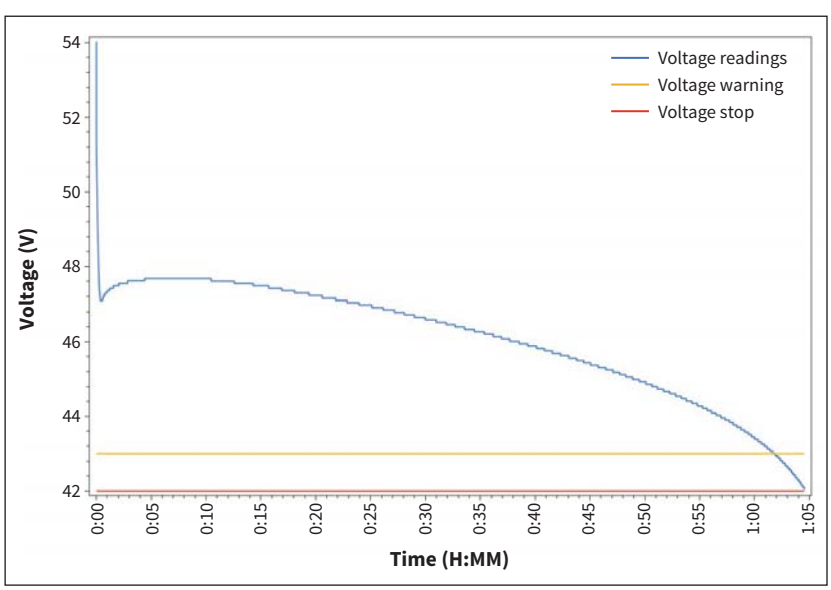


Fig. 1. Typical battery discharge curve for a 48V VRLA battery string.

WHAT IS CAPACITY?

Capacity is the ability of the battery to supply a load for a certain duration. It is measured in amp-hours (Ahr). A battery with a certain capacity (Ahr) should be able to provide a certain current (A) for a certain duration (hr). Through a discharge test or capacity test, it is possible to measure the capacity of the battery. A capacity test can determine whether the battery will be able to perform its function when an outage occurs.

WHAT IS A CAPACITY TEST?

In a capacity test, the battery is subjected to a simulated outage. Current is drawn from the battery in a controlled manner, and the battery discharge is monitored. As the test progresses, the battery voltage begins to gradually drop down to its end voltage. The time taken for the battery to reach the end voltage is used to determine the capacity of the battery. **Figure 1** shows a typical battery discharge curve.

The capacity test can be done in various ways: constant current discharge, constant power discharge, constant resistance discharge, load profile, etc. The constant current discharge method is the most popular and widely

Innovation Sparks Here

KPS®

KPS Designs, Manufactures, & Sells Products with the Highest Level of Quality and Performance.

KPS-DCM8700PV

Solar PV Clamp Meter

- V⎓ 2000
- V~ 1500
- A~ 1500
- -40°F - 752°C
- 6000 Display counts
- Ω 600k
- Hz 10kHz
- ⊣⊢ 1000µF

TRMS

KPS-DMM4500PV

Solar PV Multimeter

- V⎓ 2000
- V~ 1500
- A~ 10
- -40°F - 752°F
- 6000 Display counts
- Ω 40M
- Hz 100kHz
- ⊣⊢ 10mF

TRMS

6509 Northpark Blvd Unit 400
Charlotte, NC 28216 USA

www.kps-usa.com
(833) 533-5899

LIFETIME TECHNICAL SUPPORT

3 YEARS WARRANTY

Photo 1. Wearing the correct PPE ensures the safety of testing personnel.

used. While doing the test using this method, the test current is kept constant throughout the test.

WHY IS CAPACITY TESTING NOT PREFERRED?

Although the discharge test is a true test of the battery and provides valuable information, people are generally reluctant to do discharge testing, primarily because it is labor intensive and time consuming. It is also one of those tests that need to be done right the first time on that day. If a mistake is made while starting the test, the test cannot be restarted immediately because the battery discharge data can be affected by the previous attempt. Proper planning and preparation will ensure there are no hiccups, and a discharge test can be carried out in the right manner and with ease.

SAFETY IS ESSENTIAL

Before getting into the steps that can be taken to ensure a smooth discharge test, it is important to cover the safety aspect. The tester must be well-equipped to carry out the test in a safe manner (**Photo 1**). Personal protective equipment (PPE) includes safety glasses, face shields, acid-resistant gloves, and a protective apron. The presence of a water facility for rinsing eyes and skin after coming in contact with the electrolyte, a Class C fire extinguisher, and adequately insulated tools will ensure the safety of testing personnel.

STEPS TO ENSURE CORRECT DISCHARGE TESTING

It is important to have prior information on the battery string that is

NETA®

Electrical Testing Education articles are provided by the InterNational Electrical Testing Association (NETA), www.NETAworld.org. NETA was formed in 1972 to establish uniform testing procedures for electrical equipment and systems. Today the association accredits electrical testing companies; certifies electrical testing technicians; publishes the ANSI/NETA Standards for Acceptance Testing, Maintenance Testing, Commissioning, and the Certification of Electrical Test Technicians; and provides training through its annual PowerTest Conference and library of educational resources.

THE DIFFERENCE IS OBVIOUS

cerrowire® MC

Type MC Cable with solid or stranded conductors featuring our **Armor Color Coding System***

True Sequential Footage:
Shown every two feet

Footage Marker:
Black line = aluminum armor

Chevron Direction:
Indicates recommended pull direction

Chevron Colors:
Indicate number & color of conductors

Cable Size:
Indicates wire gauge & number of conductors

Type MC Cable
Insulated THHN/THWN-2 copper conductors with green insulated grounding conductor and separator tape. Available in solid or stranded.

Footage GUARANTEE

RoHS compliant

MC Sequential Footage

UL LISTED

*PATENT PENDING

cerrowire®

Electrical Distribution 800.523.3869
cerrowire.com

Constant Current

Discharge Rates in Amperes to 1.75Vpc at 25°C (77°F)

PowerSafe® DDm Battery Type	Ah* Capacity	Minutes					Hours									
		1	15	30	40	50	1	2	3	4	5	6	8	10	12	24
DDm-35-07	105	252	148	101	84	72	63	38	28	22	19	16	13	11	9.6	5.6
DDm50-09	200	361	242	184	157	138	123	75	55	43	36	31	25	21	18	10
DDm50-13	300	541	364	275	236	207	184	113	82	65	54	47	38	31	27	16
DDm50-17	400	722	485	367	315	276	246	150	110	86	72	63	50	42	36	21
DDm85-13	510	674	525	416	367	329	297	189	141	113	95	82	65	52	45	25
DDm85-15	595	787	613	485	428	383	347	220	164	132	111	96	75	61	52	29
DDm85-21	850	1,124	875	693	612	547	495	315	234	188	158	137	108	87	74	41
DDm85-25	1,020	1,348	1,050	832	734	657	594	378	281	226	190	164	129	105	89	49
DDm85-27	1,105	1,461	1,138	901	795	712	644	409	304	245	206	177	140	114	97	54
DDm85-33	1,360	1,797	1,400	1,109	978	876	792	504	375	302	253	218	172	140	119	66
DDm100-21	1,000	1,306	1,006	799	707	634	575	369	274	219	184	159	126	104	89	49
DDm100-25	1,200	1,568	1,207	959	848	761	690	442	329	263	221	191	151	125	107	59
DDm100-27	1,300	1,697	1,308	1,039	919	824	747	479	357	285	239	207	164	135	116	64
DDm100-33	1,600	2,090	1,609	1,279	1,131	1,014	920	590	439	351	294	254	202	166	142	78
DDm125-25	1,500	1,937	1,542	1,238	1,093	979	886	569	420	333	278	240	189	155	132	74
DDm125-27	1,625	2,097	1,671	1,341	1,184	1,060	960	617	455	361	301	259	205	167	143	80
DDm125-33	2,000	2,538	2,056	1,650	1,457	1,305	1,182	759	560	444	370	319	252	206	176	98

Table 2. A test current of 19A is required for a 5-hr constant-current discharge test to an end cell voltage of 1.75Vpc.

to be tested. Once the manufacturer and model are known, the discharge specification sheet can be obtained online. The test parameters can be determined from the discharge specification sheet. **Table 2** shows a sample discharge specification table for a constant-current test.

From this table, the test current can be determined for a certain test duration. As can be seen, shorter-duration tests require higher currents. It is preferable to select a duration closest to the duty cycle of the battery. The duration must be kept constant during subsequent discharge tests on the battery string to ensure accurate trending of the battery capacity.

Once the test current is determined, the next step is to determine the capability of the test equipment. Discharge test equipment or load testers come in various shapes and sizes. The massive ones are capable of drawing high amounts of current and can work for a wide range of battery applications but aren't portable. The portable ones may have limited power capability. Therefore, part of the planning involves running calculations to determine which testing equipment is required, as well as whether the existing testing equipment will work for a discharge test at a certain current. **Figure 2** shows the power capability of a battery discharge test system.

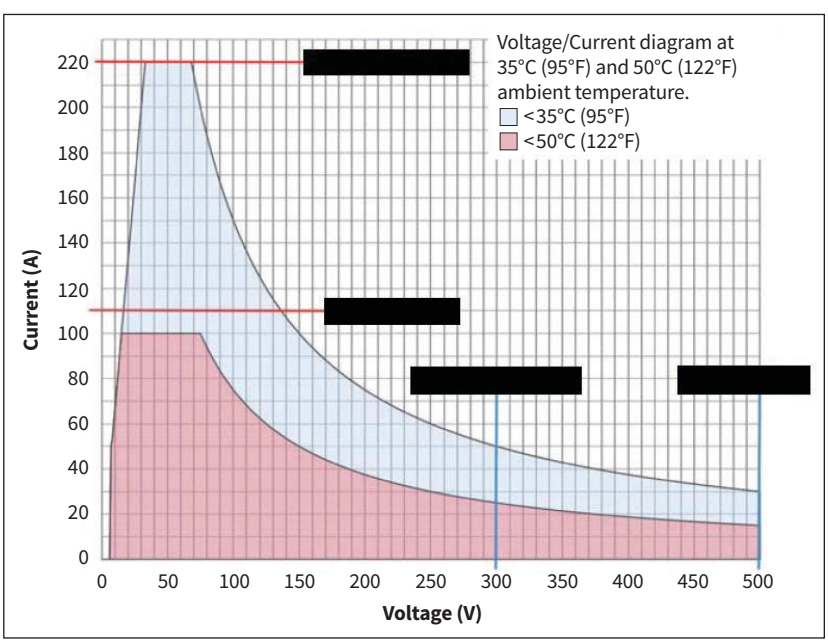


Fig. 2. Power capability curve of a battery discharge test system.

As seen from the curve, the maximum current drops with an increase in the string voltage. Hence, the string voltage is an important factor in deciding which instrument can be used for a specific test.

Besides the load bank, additional equipment can be used to monitor individual cell voltages. Monitoring individual cell discharge is certainly valuable as it can help pinpoint bad cells in a string. This is helpful in determining

Photo 2. BVMs connected to all cells on the string provide individual cell-voltage values in real-time.

whether the entire string needs to be replaced because of a bad test or if replacing a few cells in the string will fix the issue. **Photo 2** shows a discharge test setup using a battery discharge test system along with battery voltage monitors (BVMs).

Cell-voltage measurements must be done between posts of like polarity on adjacent cells so that the voltage drop along

the inter-cell connection is included. The downside of this is that a cell connected to a longer inter-cell connection (an inter-tier cable for example) can seem to have lower cell voltage than others (**Fig. 3**) because of the higher voltage drop along that longer connection.

$$V_{meas} = V_{cell} — V_{strap}$$

Arrangements must be made for a backup battery string to power critical loads while the battery string is under test. **Photo 3** on page 19 shows a backup battery string being used during a discharge test.

BYPASSING BAD CELLS IN LEAD ACID BATTERIES

During the discharge test, cells can be bypassed if they are seen approaching polarity reversal (1V or less). A maximum of one downtime period of either six minutes or 10% of the test duration (whichever is shorter) is allowed, and the tester decides at what point to take it. The duration is kept short because the cells start to recover as soon as they are disconnected from the load. Waiting too long before resuming the discharge can affect the battery discharge curve significantly and result in a much higher percent capacity being erroneously measured. Because of this short duration, it is important to have the tools nearby to quickly bypass cells. The end battery voltage needs to be adjusted for the new number of cells in the string.

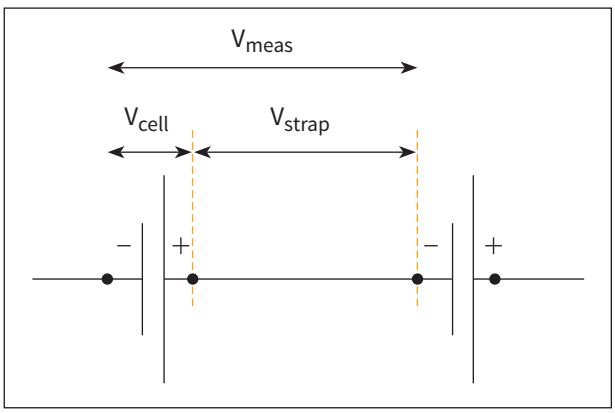


Fig. 3. Cell voltage measurement during discharge test

If all of the above measures are taken, the discharge test can be carried out smoothly. The test ends when the battery reaches the end voltage.

CAPACITY CALCULATION

The discharge duration is used to calculate the capacity at the end of the test. Capacity can be calculated using two methods.

Time adjustment method

This method is used for tests with a duration greater than an hour:

$$\% \text{ capacity} = \frac{t_a}{t_s \times K_t} \times 100$$

where:

t_a — Actual discharge time
t_s — Specified discharge time
K_t — Temperature correction factor

Rate adjustment method

This method is preferred if the test duration is less than an hour.

$$\% \text{ capacity} = \frac{X_a \times K_c}{X_t} \times 100$$

where:

X_a — Actual discharge rate
X_t — Specified discharge rate corresponding to the actual discharge time
K_c — Temperature correction factor

The percentage capacity thus obtained can be used to qualify the battery as bad or good.

ACCEPTANCE TEST

A discharge test carried out immediately after the installation or commissioning of the string is called an acceptance test. For lead acid batteries, the measured percent capacity must be at least 90% of the rated capacity for the battery to pass the test. The results obtained from this test can be used as the baseline for future measurements.

Performance tests can then be performed at regular intervals to track the health of the battery string. The battery string can be replaced once the percent capacity drops too low (80% of the rated capacity for lead-acid batteries).

Service tests or modified performance tests can also be performed to test the battery's ability in specific applications.

In the lapsed time between consecutive discharge tests, online testing can be done in the form of impedance measurements at regular intervals. Any significant deviations observed in the impedance measurements can then be investigated by conducting a discharge test. Batteries are manufactured to last for hundreds of charge/discharge cycles, so a few discharge tests done as part of maintenance do not affect a battery's service life. The discharge test provides a definitive answer and delivers the final verdict on the state of the battery.

Photo 3. DC system fed from a backup battery string during a discharge test.

CONCLUSION

A good battery maintenance program includes discharge testing among other maintenance activities. Discharge testing is the best tool for battery health assessment, and having a good understanding of the test procedure can result in the test being done in the correct manner, thus yielding accurate results.

More details regarding maintenance and testing on various types of batteries used in stationary applications are provided in the following documents:

- IEEE Std. 450–2020, *IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications*
- IEEE Std. 1188–2005, *IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications*
- IEEE Std. 1106–2015, *IEEE Recommended Practice for Installation, Maintenance, Testing, and Replacement of Vented Nickel-Cadmium Batteries for Stationary Applications* EC&M

Sanket Bolar worked previously as a substation applications engineer at Megger. Sanket graduated from Mumbai University, India, with a B.S. in electrical engineering and received his M.S. in electrical engineering specializing in power systems from North Carolina State University. Sanket is currently a staff engineer at Oncor Electric Delivery.

Reducing the Impact of Poor Job-Site Conditions

Inferior site conditions on construction projects impact labor, morale, productivity, and quality of installation.

By Sydney Parvin and Dr. Heather Moore, MCA, Inc.

Contractors may be accustomed to dealing with just about anything on the job. Worse-than-expected job conditions can be overlooked or overshadowed by even bigger problems. As a result, poor job-site conditions can unknowingly create safety risks, impact the morale of on-site workers, decrease productivity, prolong the schedule, and ultimately increase costs.

On your next walk around the job site, here are some things to look out for:

- Water flooding into the building from rain (**Photo 1**).
- Material or equipment preventing access to planned installation areas (**Photo 2**).
- Weather impacts, especially those resulting from delays in the schedule. Due to a delay in the schedule, work can be pushed into the winter months. For the crew in **Photo 3** (on page 22), this meant shoveling ice to complete fixture installation on a canopy.
- Occupants re-occupying planned work areas without notice from the GC or owner. The foreman who had scheduled work in the corridors rearranged manpower upon finding the hallway re-decorated (**Photo 4** on page 22).

Photo 1. Flooding on a job site can stall productivity.

Photo 2. Don't let your job site become an equipment parking lot.

HOW TO REDUCE THE IMPACT OF POOR SITE CONDITIONS

1. Plan. Use a work breakdown structure to plan for safety hazards and less-than-favorable conditions. When site conditions change, your work breakdown structure should be updated to reflect any increases in effort on installation tasks for the differing work environment.

2. Monitor productivity and schedule impacts due to poor site conditions. Using tools like short interval scheduling (SIS®), contractors can pinpoint where, when, and how unplanned site conditions impact scheduled work. SIS's application of ASTM Standard E2691 helps to codify job-site obstacles across your projects, allowing field supervisors to report job conditions and obstacles as they arise so that the company and project manager can respond effectively.

The **Figure** on page 22 illustrates the application of the standard and SIS tool. In this example, the foreman was running three school renovation projects and experiencing disruptions frequently due to issues with access to work areas within two of the buildings. The project team looked into this obstacle and learned that this had happened five times within a two-week period, disrupting a total of 32 hours of scheduled work. They were able to use this data to communicate the impact to the general contractor and come up with a solution to improve coordination. As a result, obstacles due to site conditions (such as the issue reported in the **Figure** and shown in **Photo 4**) were resolved.

Atkore™
FRE Composites

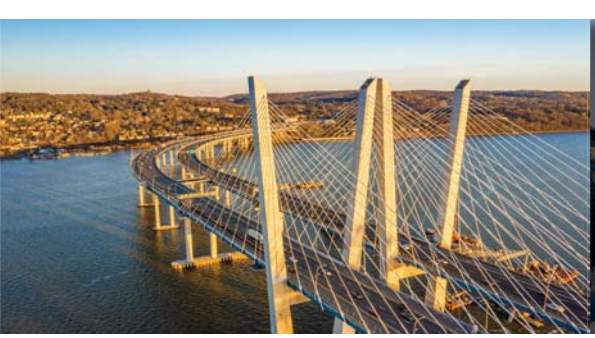
Critical for Infrastructure and Built to Last Fiberglass Electrical Conduit Systems

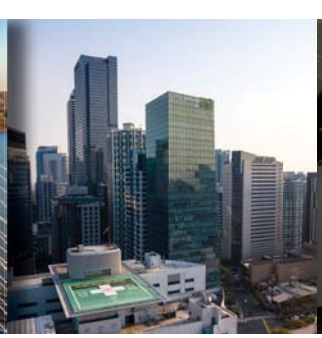
BreathSaver® XW Conduit and Fittings

- UL2916 Certified, providing 2-Hour Fire Rating in both Horizontal and Vertical applications
- Meets NFPA 502 and NFPA 130 standards, making it the premier choice for tunnel or transit
- Easier to work with and more cost efficient than mineral insulated cable

Epoxy Conduit and Fittings

- Corrosion resistant; holds up to water, salt water and most industrial chemicals
- Patented one-piece TriSeal® for easy push-fit installation
- Suitable for direct burial (DB), encased burial (EB), and exposed above ground applications

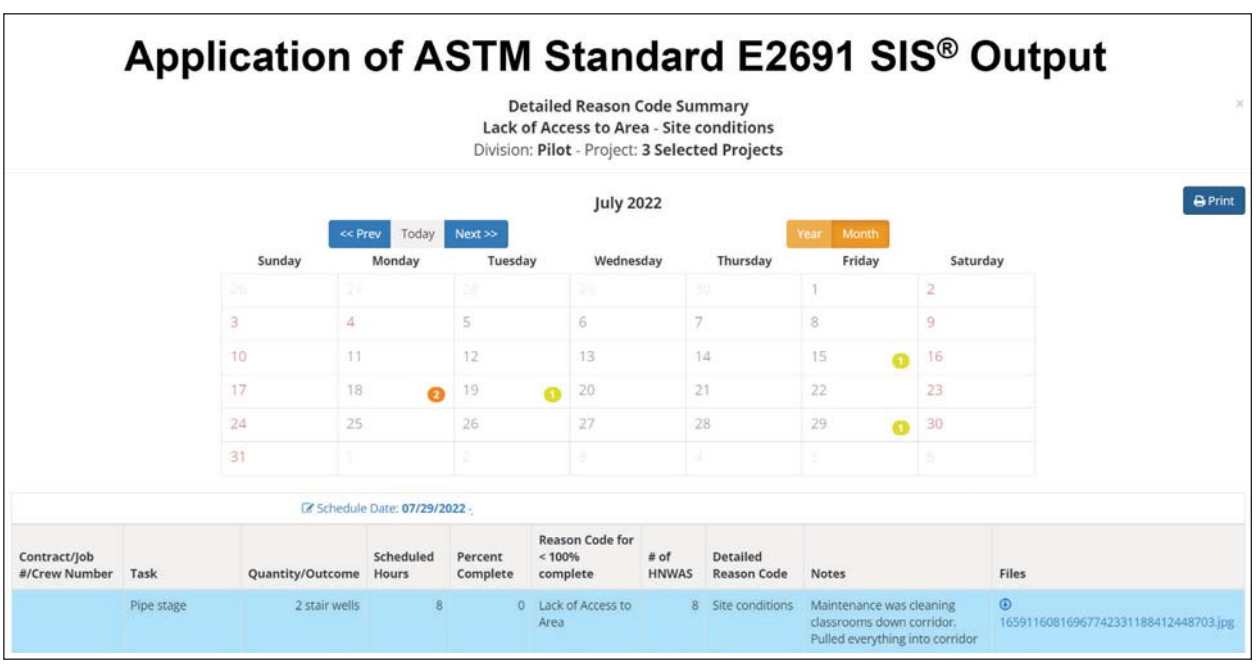




Learn how to save Time and Money with Epoxy and Phenolic Conduit Solutions → **atkore.com/fre**

Photo 3. Project delays can push work into winter months, resulting in weather hazards that can further impede job-site productivity.

Photo 4. Unplanned occupancy can require foremen to reassign work.



In this example, the foreman was running three school renovation projects and experiencing disruptions frequently due to issues with access to work areas within two of the buildings.

Project schedules can also be used for long-term visibility of the work and monitoring of project delays. A *EC&M* article "Mastering the Electrical Work on a Mega Projects" (https://ecmweb.com/20896625) discussed project scheduling and dealing with project delays through the use of Work Environment Management™ (WEM®).

Productivity tools like JPAC® can also allow contractors to monitor trends in productivity and document reasons for productivity loss that are driven by differing site conditions.

3. Communicate. With the right processes in place to plan for, monitor, and document project obstacles, project management teams can respond quickly and more effectively communicate with the contractor, owner, or project manager to express concerns. Unexpected site conditions drive costs for everyone and can delay the project's completion. Using a data-driven approach allows the project team to be responsive and effectively relay the impact in terms of productivity and scheduled work.

4. Contract considerations. Including contingencies in your bid to request all information available to the owner and conducting your own extensive site investigations can decrease the risk of added costs on your projects. EC&M

Sydney Parvin is associate data analyst at MCA, Inc., Grand Blanc, Mich. She can be reached at sparvin@mca.net. Dr. Heather Moore is vice president of customer care and support. She can be reached at hmoore@mca.net.

Expanded Control, Fewer Components

ARISTA™

Practical Options with Outputs to Match Your Needs

New ARISTA ALC2-R 2-Channel and ALC4-R 4-Channel Room Controllers help installers do more with less. The versatile controls build on our existing ARISTA System by offering 0-10 V dimming, plug-load control, standard ON/OFF control, and built-in advanced scheduling capabilities to create dynamic, code compliant lighting environments.

Designed for Spaces Big and Small

- Hospitals
- Retail stores
- Commercial facilities
- Offices
- Government buildings
- Schools

Scan the QR code to learn more about the benifits of the ARISTA Line Extension.

Learn more today at **Intermatic.com/ARISTA**

INTERMATIC®

2023's 30 Under 30 EC&M ELECTRICAL ALL STARS

An inside look at how these young electrical professionals are innovating best practices, investing in training and technology, and moving the industry forward

By Amy Fischbach, Freelance Writer

The electrical industry is expanding and evolving right alongside the workforce. As America's power needs continue to change, more young people are embracing opportunities across the sector — from engineering to project management to the electrical trade.

While these new employees are helping to keep the lights on and power flowing, a special group of electrical professionals is innovating and driving change. This year's *EC&M* 30 Under 30 special report honors 30 up-and-coming leaders with bright futures and the passion to succeed.

For example, Maria Ellis of M.C. Dean, one of nine women featured, takes pride in working as a young woman engineer in the electrical industry.

"The amount of woman engineers has increased significantly over the past few years, and I love to see them succeed," she says.

Joshua Fetzner, vice president of commercial construction for Titan Electrical Services, says the electrical industry offers a lot of opportunity for everyone.

"The trades are lacking good young talent," Fetzner says. "Don't be afraid to learn a trade — it's something that everyone needs and will always be around."

The electrical trade runs in the family for Fetzner, whose dad and brother are both electricians. The same is true for Electrical Facilities Engineer Jordan Emch, the son of an engineer. He says he's honored to be nominated and selected for *EC&M*'s 30 Under 30.

"I always enjoy opportunities to share personal experiences with others, and this feature gives young professionals in the industry an opportunity to connect, learn, and grow together," Emch says.

Following are the stories of 30 young electrical professionals who are helping to power America, make their mark, and continue to inspire change in the electrical industry.

Amy Fischbach (amyfischbach@gmail.com) is a freelance writer and editor based in Overland Park, Kan.

Advice for Aspiring All Stars: What You Need to Succeed

Each year, new young professionals enter the electrical industry. This year's 30 Under 30 group shares what it takes for up-and-comers to thrive in their careers.

1. Excitement and passion mixed with hard work and professionalism. This is the perfect recipe for success in the electrical industry, says Roberto Reyes, an electrician with Interstate Electrical Services Corp.

2. Thirst for knowledge. To succeed, it takes a desire to learn and truly understand things and how they work instead of just how to apply them, says Ian Smith, electrical engineer for CDM Smith.

3. Listen and learn. Even if your crew members are teaching you something you already know, they might know a trick that makes the job easier, says Makenna Pearlman, journeyman electrician for Brattan Industries.

4. Good attitude. Even if you are having the worst day, it's essential to have a positive mindset, says Dylan Hewitt, estimator for Compass Electrical Solutions.

5. Self-management. Beyond managing your time, materials, and information, you need to focus on emotional intelligence, integrity, and conscientiousness, says Jesse Mitchell, apprenticeship coordinator for Claypool Electric.


TITAN
ELECTRICAL SERVICES


HEC
Hill Electric


ROSENDIN


ROSENDIN
PAOLA MORALES

ANGEL AVENDANO

Job Title: Electrical Apprentice
Company: Power Design
Location: Washington, D.C.
Age: 25; **Years on the Job:** 3
Interests: Spending time with family and taking his kids to their favorite spots

Born in Oaxaca, Mexico and raised in Maryland, Angel Avendano is the only one in his family working in the electrical field. After graduating from high school and completing two years of college, he is currently finishing his third year as an electrical apprentice with Independent Electrical Contractors (IEC).

"I've always been curious about how everything was getting powered," he says. "My training has helped me to learn more about how everything in the trade works as well as asking other people who have been in the trade for a longer time for advice or guidance whenever I don't understand something."

An ambitious person, he enjoys getting feedback on his work from his mentors so he can learn to better himself. He says he also likes learning new things and always asks questions. His daily responsibilities include pulling wire, bending pipe, looking at prints, and taking count on material as needed.

"I like everything about the job from where it starts down in the hole to the last part where we are making final touches in order to hand over the building," Avendano says.

Apprentice Angel Avendano says technology allows him to be more efficient and accurate in the workplace.

His team just finished the City Ridge project in Washington, D.C., and he helped with the fire alarm and electrical parts of the project.

"It was a good learning experience, since it was a total of 10 buildings in that particular project," he says.

In the future, he aims to work as a superintendent or a higher position if possible.

"I plan on reaching my goals by working hard, taking in what my mentors teach me, and always learning more," he says.

EC&M ALL STARS 2023 UNDER 30

MARISA BAILEY

Job Title: Project Engineer
Company: ArchKey/Sprig Electric
Location: San Jose, Calif.
Age: 28; **Years on the Job:** 4
Interests: Being outdoors in nature, taking a scenic drive near the ocean, or hiking in the mountains

Marisa Bailey pursued a career in the electrical industry after earning her bachelor's degree in environmental studies from San Jose State University.

Marisa Bailey has presented Title 24 presentations in this conference room.

"I was eager to learn about energy efficiency standards and laws and implement them into real-life projects," she says.

She has directly assisted in presenting a training series to in-house designers and project managers regarding Title 24 Part 6, a law adopted by the state to reduce negative impacts on the electrical grid and maximize energy efficiency. She also retrieves and enters in data to complete the Title 24 documentation for all qualifying projects and calculates lighting power densities for each area within the project for compliance with lighting controls. After serving as the lead Title 24 compliance coordinator for her company, she recently moved into a project engineer position supporting her company's preconstruction department.

"I hope to learn about a whole different side of the industry and apply my knowledge there," she says.

Bailey also recently obtained a Leadership in Energy and Environmental Design (LEED) accredited professional credential for building design and construction.

She says technology is key in today's world, especially serving in the virtual design and construction department.

"I am able to take our 3D models and fly through them to visualize what the project really looks like," she says. "Without technology, I wouldn't have access to visualizing the project without being at the project site in person."

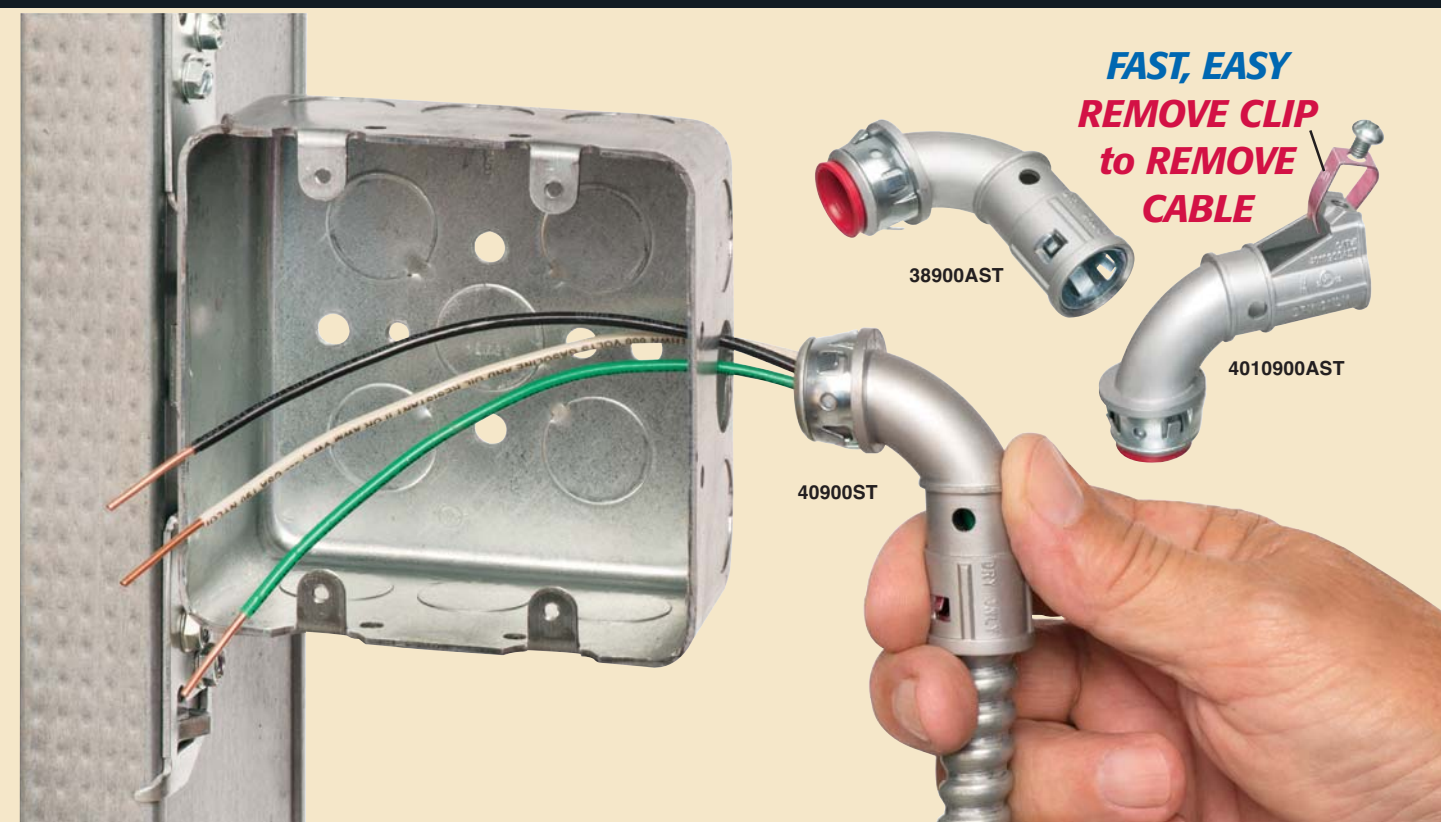
In the future, she envisions herself serving as a resource relating to Title 24 and preconstruction, continuing to ask questions, and growing with her company.

"I feel as if I have come a long way since I first started in the electrical industry four years ago, and I can't wait to continue learning and growing within it," she says.

NO TOOLS! • EASY CABLE INSERTION Made in USA

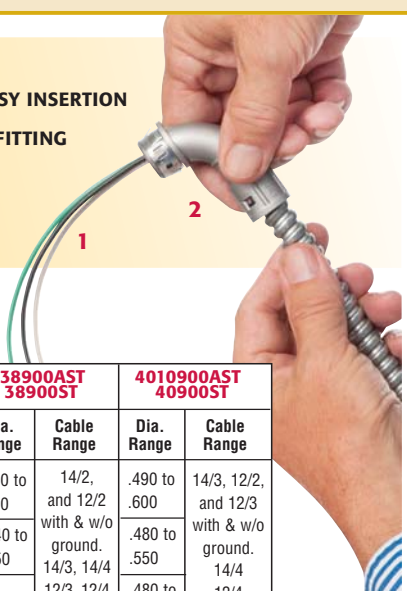
SNAP2IT® 90° CONNECTORS

WITH and WITHOUT INSULATED THROAT



EASY TO INSTALL

1. **BEND CABLE FOR EASY INSERTION**
2. **INSERT CABLE INTO FITTING**
3. **SNAP ASSEMBLY INTO BOX** *(SEE ABOVE)*



- Easy snap-in cable installation ***Save time over 90° 2-screw MC Connectors at same cost per connector***
- Handles widest range & variety of cables: 14/2 to 10/2 AC, MC, HCF, MC continuous corrugated aluminum cable, MCI-A cables (steel & aluminum), AC90 and ACG90
- Fast, secure installation...No pullout
- Easy to remove from box...reusable

SAVE 1 MINUTE *per connector over 2-screw styles*

90° SNAP2IT® CABLE RANGES

CABLE TYPE	38900AST 38900ST		4010900AST 40900ST	
	Dia. Range	Cable Range	Dia. Range	Cable Range
MC/HCF/AC Steel & Aluminum	.380 to .600	14/2, and 12/2 with & w/o ground. 14/3, 14/4 12/3, 12/4 10/2	.490 to .600	14/3, 12/2, and 12/3 with & w/o ground. 14/4 12/4 10/2
MCI-A Steel & Aluminum	.440 to .550		.480 to .550	
AC90, ACG90			.480 to .550	
Flexible Metal Conduit Steel & Aluminum (RWFMC)	**3/8" Flex*** *CSA Listed w anti-short bushing ONLY			

Arlington®

c UL us
with and without insulated throat

Patented

www.aifittings.com Scranton, PA 18517 **800/233-4717**

Product Info aifittings.com/landing/90-degree-connectors/

EMILY BOSS

Job Title: Electrical Engineer
Company: P2S
Location: Seattle
Age: 28; **Years on the Job:** 5
Interests: Reading, aerial silks, golfing, spending time with loved ones, and volunteering on committees for the Washington State Society for Healthcare Engineering and The Pro Shop

From a young age, Emily Boss loved math and knew she wanted to have a career in STEM. Unlike many of her colleagues, however, she didn't grow up tinkering in the shop.

"I took an interest in computers in high school," she says. "In college, I discovered my interests and strengths aligned more with electrical engineering than computer science."

Following her second year of college, she transferred from Rochester Institute of Technology to Seattle University, where she earned her bachelor's degree in electrical engineering.

After she was accepted into the electrical engineering program, she learned that it ran in her family. Her grandfather was an electrical engineer, her father was an electronics technician in the nuclear power program for the U.S. Navy, and her brother is a high-voltage electrician for NAVFAC NW.

While in school, Boss interned at Tacoma Power and worked at the MEP consulting firm, Säzän Group. She transferred to her current job about a year ago. At P2S, she just completed an internal project management training series and is a mentee in her company's year-long Advanced Mentor Program. She has also participated in electrical huddles and lunch-and-learns and attended conferences and meetings to learn as much as possible.

Emily Boss gets to work on a variety of fast-paced, challenging projects as an electrical engineer.

"I've been afforded a great deal of opportunity and support," says Boss, a licensed professional engineer in the state of Washington. "Plus, I try to never turn down a chance to learn, no matter how big or small."

As an electrical engineer, she prepares drawings and load calculations, conducts power systems studies, and attends site visits, client meetings, and conferences. In five to 10 years, she hopes to be in a management position and continue developing as an engineer, project manager, and consultant.

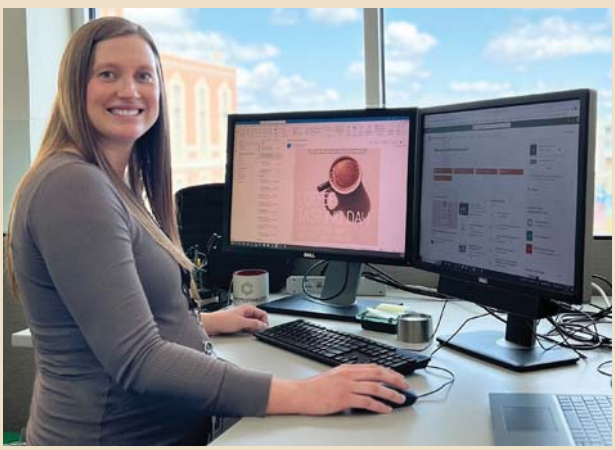
"I intend to continue pushing myself outside of my comfort zone and remain open to trying and learning new things," she says.

EC&M ALL STARS 2023 UNDER 30

SHELBY BRAJAK

Job Title: Transmission Line Engineer
Company: Commonwealth Associates
Location: Jackson, Mich.
Age: 29; **Years on the Job:** 7
Interests: Camping, hiking, snowboarding, baking, and spending time with her husband and two dogs, Luna and Pad

As a civil engineering major in college, Shelby Brajak wasn't planning to work in the electrical industry until closer to graduation.



Shelby Brajak always looks for ways to improve internal processes and create more efficient design calculation tools.

"I always thought I might work in the oil and gas industry, with my focus being in geotech, but that industry was in somewhat of a downturn as I was completing my degree," she says. "I was looking for a non-typical civil engineering field that was stable and would have an abundance of work for a very long time."

With the increasing need for power and the rebuilding of transmission lines, the electrical industry fit her needs perfectly, she says.

"I am very happy with my decision to go into this field," says Brajak, who was born and raised in Regina, Saskatchewan, Canada. "I think it's one of the most interesting fields you can be in as a civil engineer."

Brajak earned an athletic and academic scholarship to Michigan Technology University, where she graduated cum laude with a bachelor's degree in civil engineering and a minor in geological engineering. She passed her FE in her last semester and her PE in the summer of 2021.

When she started, she focused on task-based work for other engineers but is now responsible for the design execution, scope, schedule, and budget. She also has direct reports and mentors younger engineers.

Working in the electric utility industry is a rewarding career that keeps her engaged, she says.

"Every project has its differences, and no two designs are the same, which is something I really enjoy," she says. "I will continue to mentor young engineers while enhancing my own knowledge and skillset."

SHIPS AS AN 'LB'... ANYBODY®

...BUT IT'S ANY BODY YOU WANT IT TO BE!

Arlington's aluminum *or plastic* **AnyBODY**™ ships as an LB, but converts *FAST* to a T, LL, LR or C by switching the cover plates and threaded flanges to create the style you need.

Easy and convenient, it saves you the hassle and cost of carrying five different conduit bodies.

- Competitively priced with LBs – ***NO EXTRA COST for the normally more expensive T*** – UL/CSA Listed
- **Plastic 1/2" to 4"** includes three flanges w/ glue-in pipe joint.
- **Aluminum 1/2" to 4"** includes threaded flanges for three openings. 1/2" to 2" are combination bodies: threaded for rigid, they also have a set-screw for use with EMT.

Aluminum T...C...LR...LL

800/233-4717 • www.aifittings.com

Product info aifittings.com/landing/anybody

DUPLEX • DIECAST ZINC

Made in USA

COMBINATION COUPLINGS

TRANSITION from EMT to FLEXIBLE METAL CABLE... **THE EASY WAY!**

Arlington's new duplex diecast couplings save time and money! They allow ***easy transitions from 3/4" EMT to 3/8" trade size flexible metal cables*** – perfect for running MC cable above a drop ceiling and connecting to *surface mounted* EMT to feed a box or switch.

8675 and **8675SG** combination couplings install easily on AC, MCI-A, HCF steel and aluminum cable, flexible metal conduit (steel and aluminum, regular and reduced wall), MCI cable and continuous corrugated aluminum. And offer independent securing of different size cables.

- Tested, LISTED to exceed UL ground fault requirements
- **Ships Assembled –** Compatible with 3/4" EMT

Available in Snap2It® ...and SADDLE GRIP® styles

800/233-4717 • www.aifittings.com

Product info aifittings.com/landing/zinc-combination-couplings

Tyler Burley says his company invests in the latest technology and trains the field workforce so everyone knows how to use it.

TYLER BURLEY

Job Title: Foreman
Company: Encore Electric
Location: Falcon, Colo.
Age: 27; **Years on the Job:** 9
Interests: Hanging out with family, hunting, fishing, and playing golf

As the son of an electrician, Tyler Burley decided to follow in his father's footsteps in the electrical trade.

"I saw that my dad made a great career out of being an electrician," says Burley, who was born and raised in Colorado. "I enjoy building things and working with my hands, so I decided to become an electrician as well. I loved it and never looked back."

He spent 8,000 on-the-job hours or four years for his apprenticeship and four years of trade school at the IEC. Today, he continues staying sharp by keeping an open mindset and staying involved in classes provided by his company's in-house training program, Encore University.

"As an electrician, my training and education never really ends," he says. "There are always things to learn."

In his current role as a superintendent, he makes sure the job stays on schedule and everything is installed at a high level of quality. In addition, he makes sure everyone is working safely.

He says his favorite part of the job is planning a job, seeing the plan come together, and watching his workers learn and grow.

"There are always challenges like schedule, working with other trades, and things not going exactly as they should, but you can overcome all the challenges and still be successful," he says.

At his company, he has been involved in complex projects — from hospitals to data centers to stadiums. According to Burley, technology plays a huge role and makes their jobs easier. In 10 years, he plans to still be working for Encore Electric.

"I love being a superintendent and running work and being out in the field, but I could possibly see myself taking on more of an office role down the road," he says.

DANIELA DIAZ

Job Title: Assistant Project Manager
Company: Rosendin Electric
Location: Austin, Texas
Age: 25; **Years on the Job:** 2
Interests: Playing with her dog, Nala; playing soccer; and working out

Daniela Diaz was exposed to the electrical industry for the first time during a summer internship with Rosendin. Later at Texas A&M University, she took MEP classes to further her knowledge.

"Because of this exposure, I realized that working for a subcontractor made the most sense to me," she says. "I like the fact that I can own one specific and very important part of the job."

Born in Mexico City, Diaz was raised in different parts of the world. She said she moved around a lot due to her parents' jobs, which gave her the ability to quickly adapt. She is also bilingual in English and Spanish, which has set her apart in the electrical trade.

"I moved to the United States in 2011 and have been here since then," she says. "Last month, I received my U.S. citizenship, which was a huge milestone in my life."

Diaz, who earned her bachelor's degree in construction science, served as an officer for the AGC student chapter and the leader coordinator in her university's interdisciplinary competition. She also interned with a general contractor.

"My internships were also a game-changer for me," she says. "I was able to see how everything I was learning in the classroom translated into an actual building."

Now at Rosendin, she says her favorite part about her job is that every day is different.

"Having a clear understanding of my goals and what needs to get done helps me stay on track," she says.

In the future, she sees herself being a successful senior project manager. She said that her parents' sacrifices have helped her to get to where she is today.

"I will keep an open and hungry mind to keep learning and using this knowledge to make this industry even better than what it already is," she says.

As an advocate for technology, Daniela Diaz says she is in constant communication with peers at other companies to learn how to improve and implement new tools.

FOR POWER OR LOW VOLTAGE CABLE

Made in USA

CABLE WAY™

Listed as Cable Runway Support System

CABLE SUPPORT SYSTEM FOR NEW WORK OR RETROFIT

Patented

Try Arlington's easy to install **CableWay™**, for a secure, UL Listed cable runway support system.

System components get the job done quickly and easily.

Support Brackets attach directly to framing members, without structural damage. They hold cables securely in place, and open for easy cable insertion!

The **Slide-On Trough** holds and protects cable. To add length, install more sections that join together with **Coupling**.

Angles and **Tees** make turning corners a breeze.

Push-on **End Caps** complete the job!

Product info
aifittings.com/landing/cableway-series

Arlington® 800/233-4717 • www.aifittings.com

ONE-PIECE. SAVES TIME – LOOKS GREAT!

Made in USA

RECESSED IN BOX®

LOW PROFILE, EXTRA DUTY COVER • *TWO STYLES for 1-1/2" and Foam Wall Systems*

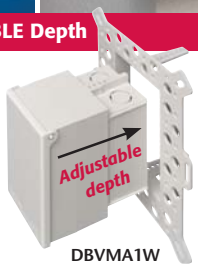
One-piece **IN BOX®**, the recessed electrical box for exterior use, eliminates installing an electrical box and bubble cover assembly, so *you save big* on labor and materials.

IN BOX installs in the wall – so less shows outside. Fewer parts to handle. Time savings. *A great-looking job with Arlington's IN BOX!*

- Non-metallic, 22.0 cu. in. box with EXTRA-DUTY weatherproof-in-use clear or white cover
- Accepts single-gang devices; no gaskets required

© 2011-2015 Arlington Industries, Inc.

Fits ANY foam board *on 2-3/4" to 5" wall or* ***custom stucco finishes*** *1/4" to 2-1/2" thick.*



DBVMA1W
white cover

Product Info aifittings.com/landing/db-series

IN BOX MEETS 2020 NEC Section 406.9 *for protection of exterior outlets which require the use of extra-duty weatherproof-in-use cover for all outdoor 15 or 20 AMP receptacles.*

For ***1-1/2" wall systems,*** *including foam. Eliminates separate flashing.*

DBVME1W
white cover

Patented/Additional patents pending

Arlington® 800/233-4717 • www.aifittings.com

JOYEUSE DUFITUMUKIZA

Job Title: Electrical Project Engineer
Company: IDS Group
Location: Irvine, Calif.
Age: 28; **Years on the Job:** 6
Interests: Playing basketball, getting Boba with friends, and participating in her worship group at church

Born and raised in Rwanda, Joyeuse Dufitumukiza had a father who was a civil engineer and a mom who is a math teacher.

"She encouraged me to study hard, especially in STEM," she says.

Her hard work paid off, and she earned a full Rwandan president scholarship to California Baptist University, where she graduated with a degree in electrical and computer engineering.

"My education taught me to think like an engineer, to find the most effective and efficient way to solve a problem," she says. "The rest was from work trainings and experiences, but the basics I learned in school."

In her job as an electrical design engineer, her day-to-day responsibilities involve design and drafting, communication with clients and team members, and occasional site visits. She enjoys working with her colleagues and the lighting design aspect of her job.

She is challenged, however, about navigating a male-dominated field as a Black female engineer.

"I have people ask me where the engineer is, and I have to say, 'I am the engineer,'" she says.

Currently, her company is working on the third Orange County Library and 12 high-security gates at LAX Airport. When she first started working, they used to print out plans and mark them by hand, but now they can use software instead.

As Joyeuse Dufitumukiza is progressing in her career, she says she is focusing on project management and being trusted with more important projects.

"I think technology is crucial not just to make an engineer's life easy, but it benefits a company as far as productivity goes," she says.

In the next five years, she plans to start her engineering consulting business. Then she strives to be an owner and CEO in the next decade. She says it feels wonderful to be part of the 2023 *EC&M* 30 Under 30.

"I am so happy, and it's wonderful to be recognized," she says. "I am encouraged to keep going and to accomplish even more in the future."

MARIA ELLIS

Job Title: Electrical Design Engineer
Company: M.C. Dean
Location: Tysons, Va.
Age: 23; **Years on the Job:** 2
Interests: Playing soccer and volleyball, painting, doing DIY projects, and baking

During her high school engineering course, Maria Ellis was selected to participate in the IEEE Olympics at a local college, which sparked her interest in electrical engineering. She also interned with the Department of Defense during her time at Penn State for two summers in a row.

"Both summers included working alongside electrical engineers observing their day-to-day tasks and understanding the power design industry," she says. "These internships guided me in the path of electrical engineering that I currently work in."

Born and raised in Mountain Top, Pa., she graduated with a bachelor's degree in electrical engineering and a minor in engineering leadership development. She is working toward her PE and LEED AP and has obtained her LEED Green Associates designation.

As an electrical design engineer, she is working on a federal project in Maryland. On a day-to-day basis, she is developing detailed electrical designs while working in a multi-disciplinary team to ensure all power requirements are achieved and a quality design is produced. The most challenging part of her current role is the fast-paced schedule.

"I thrive in this type of environment because of the learning opportunities I get in a shorter amount of time," she says. "I also love how closely I am able to work with our trade partners to develop strong relationships and work together as a team."

In five years, she hopes to have accomplished two goals — earned her master's degree in renewable energy and obtained her PE license.

"I am working toward becoming an engineering leader within my company, which includes leading a team of design engineers while also having a technical background to assist in future projects and solutions," she says. "I strive to be a role model engineer for my peers and succeed in a diverse and challenging industry."

Maria Ellis is now taking on more of a leadership role on her current project by leading the design and advocating for her team.

ADJUSTABLE • NON-METALLIC • 2-HOUR FIRE RATING

Made in USA

IN/OUT™ BOX for Fans & Fixtures

EASY TO INSTALL... IN NEW CONSTRUCTION

Arlington's **IN/OUT™** ***fan/fixture boxes*** adjust up to 1-1/2" to accommodate varying ceiling thicknesses, like single or double drywall. **FBA426** is Listed for fans up to 70 lbs; fixtures up to 100 lbs.

- Pre-set for 1/2" ceiling – depth adjustment screw positions the box flush with the ceiling *after it's in place*
- Complies with 2020 NEC, 314.20 for set back boxes
- (4) screws attach box securely to joist in new work
- **2-Hour Fire Rating**

Patented

20.0 cu in **FA426** for Fixtures *only* up to 50 lbs

1 Cutaway: Box set back in double drywall

2 Install ceiling. If necessary use depth adjustment screw to position box flush with ceiling.

Arlington® 800/233-4717 • www.aifittings.com

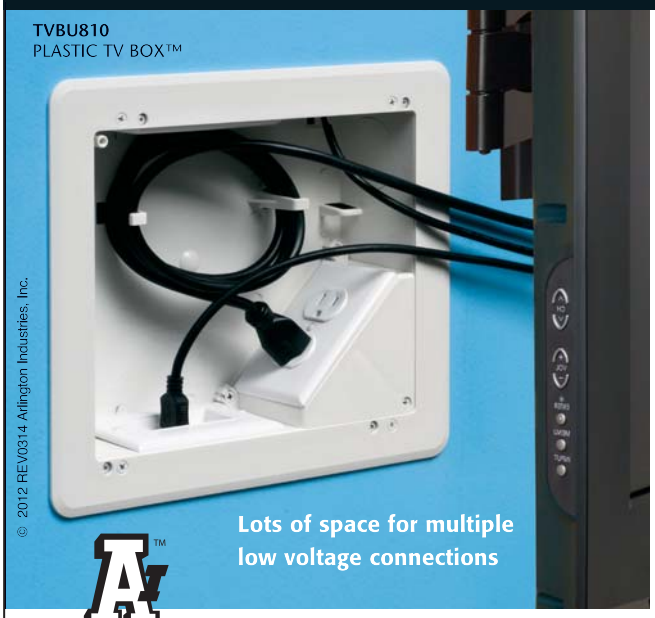
Product info aifittings.com/landing/fba426

VERTICAL OR HORIZONTAL • RETROFIT & NEW WORK INSTALLATIONS

Made in USA

Non-Metallic 8x10 TV BOX™

PERFECT FOR HOME THEATER SYSTEMS



Arlington's PLASTIC 8X10 **TV Box**™ delivers the *ultimate in versatility* for installing flat screen TVs in new *and* retrofit projects. There's more room in the box for wires and it installs horizontally or vertically to properly position low voltage connections behind the TV.

- Ideal for home theater systems: multiple connections for sound systems, satellite TV, CATV, DVRs
- Brackets for neater cables, with a 1-1/2" knockout for ENT and other low voltage wiring
- Box mounts to stud in new work; for retrofit, mounting wing screws secure box in wall

Mounts to stud in NEW work

Secure installation in RETROFIT

includes box, trim plate, duplex receptacle, line voltage box, wall plates, cable entry device, knockout plugs

Arlington® 800/233-4717 • www.aifittings.com

Product info aifittings.com/landing/TVBU810

Emch has extensive training and experience with various codes and standards for electrical equipment installation, safety, maintenance, and operation.

JORDAN EMCH

Job Title: Electrical Facilities Engineer
Company: UT-Battelle/Oak Ridge National Laboratory
Location: Oak Ridge, Tenn.
Age: 28; **Years on the Job:** 4
Interests: Fishing, hiking, boating, snowboarding, and traveling with his wife, Kayla

From a very young age, Jordan Emch was very interested in how things work.

"I recall very clearly taking apart the family computer that stopped working when I was nine or 10 years old to try and fix it," he says. "My parents were not thrilled to find that the now disassembled computer could not be easily put back together."

Born in Colorado, Emch moved to Tennessee when he was eight years old. He then graduated with a bachelor's degree in electrical engineering with a concentration in power systems at Tennessee Technological University. During the summers, he worked as an intern at Oak Ridge National Laboratory (ORNL) in the Supercomputing Computational Complex with the Facilities and Operations Group.

"My time spent as an intern at ORNL was instrumental in my overall development as an electrical engineer and gave me exposure to real-world problems in a complex and critical operating facility," he says.

This experience also solidified his choice to concentrate in power systems and work in a support role at a critical operating facility. After graduation, he also worked as a protection and controls engineer for a design firm, and his training helped him to support the medium-voltage distribution system in his current role.

As an electrical facility engineer at Oak Ridge National Laboratory's Spallation Neutron Source (SNS), he is responsible for maintaining the configuration and continued operation of the electrical systems at the SNS campus.

He is currently pursuing his professional engineering licensure and the International Code Council E2, Commercial Electrical Inspector certification. In five to 10 years, he sees himself leading a team at a critical and complex operating facility.

"I find myself gravitating more and more toward providing higher levels of support, such as project and personnel management," he says.

JOSHUA FETZNER

Job Title: Vice President Commercial Construction
Company: Titan Electrical Services of Southwest Florida
Location: North Fort Myers, Fla.
Age: 28; **Years on the Job:** 12
Interests: Riding dirt bikes, bowling, keeping a saltwater fish tank, swimming, and spending time with his wife, Samantha, and dog, Paisley

During his childhood in Erie, Pa. and Cape Coral, Fla., Joshua Fetzner remembers he and his brother working for their dad, an electrician.

"I cleaned out the warehouse, pulled material for the next job, and eventually started installing receptacles with my dad doublechecking behind me," he says. "By the time I was 20, my dad started his own company, and I was running small projects with three- to four-person teams."

In his early 20s, however, he got unexpectedly very sick and was unable to work in the field. Following a diagnosis of chiari malformation and emergency brain surgery, he spent a year in the healing process. His dad then decided to transition his son's role to estimating.

"He had always done the estimating long-hand but felt like this was a good stepping stone for our company to grow with," he says. "I moved to the office, learned the software, and before long, began training others. Eventually, I oversaw the estimators and became a project manager."

At 28 years old, he passed the Florida state master's exam, and he now oversees three project managers and an estimating crew of four. He supervises commercial projects ranging from small buildouts to large hotels, schools, and hospitals and has 31 team members under his leadership.

In the future, he would like to branch out to other locations within the state of Florida, and he and his brother will eventually take ownership of the company. He says his younger brother was selected for the 30 Under 30 a few years ago.

"I think it's pretty cool," he says. "I have to keep up with him, as he was picked back in 2021," he says.

Joshua Fezner comes from a family of electricians with both his brother and dad in the electrical trade.

NON-METALLIC NM3100 SERIES • PRE-INSTALLED STRUT CLIP

Made in USA

QUICKLATCH™

EASIER TO USE THAN A PIPE HANGER

NEW NM3100 series

Patent pending

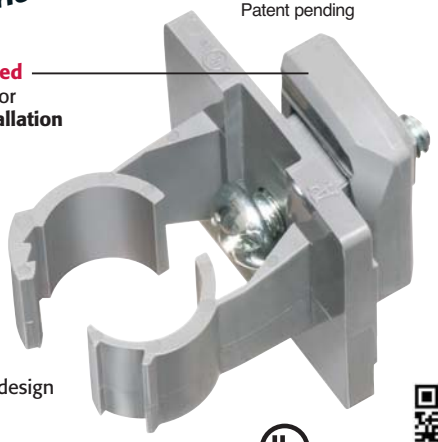
Pre-installed strut clip for **faster installation on strut**

Stainless steel screw

UV rated for use outdoors

Extra-duty one-piece design

Listed for environmental air handling spaces



MOUNT. PRESS PIPE into QUICKLATCH. DONE!

SAVES 20 SECONDS per Installation!

...about 33¢ each at $60/hr labor!

1/2" NM3105 for RIGID, IMC, PVC – **NM3100** for EMT
3/4" NM3115 for RIGID, IMC, PVC – **NM3110** for EMT
1" NM3125 for RIGID, IMC, PVC – **NM3120** for EMT

Arlington® 800/233-4717 • www.aifittings.com

Info aifittings.com/landing/quicklatch_series

ONE-PIECE • NON-METALLIC

Made in USA

METER MOUNTING BASE

INSTALLS ON SIDING – AND OTHER SURFACES

Arlington® 800/233-4717 • www.aifittings.com

Arlington's one-piece, non-metallic Mounting Bases provide a smooth, flat mounting surface for most electric meters, *including the largest sizes* – as well as a variety of other products such as timers, disconnects, inlet boxes and more.

UV rated, paintable plastic for long outdoor life.

Available with squared-off corners, they're *gangable* so you can create the mounting base you need for the product you're installing.

NEW 5x7

NEW

MM7 5" X 7"	MM18	15-7/8" X 17-5/8"
MM10	7" X 10"	
MM23	17-5/8" X 23"	

MM7 info aifittings.com/landing/mm7
Other aifittings.com/landing/meter-mounting-bases

GRIFFIN HEIDENREICH

Job Title: Electrician
Company: Edgewood Electric, Inc.
Location: Edgewood, Ky.
Age: 25; **Years on the Job:** 4
Interests: Hanging out with family and friends, going to Bengals games, and watching movies

Griffin Heidenreich tries to learn all he can about the newest technology for the electrical industry.

Born and raised in Kentucky, Griffin Heidenreich knew he always wanted to work in a trade, and the electrical industry caught his eye.

After spending four years in his company's schooling and apprenticeship program, he earned his OSHA 10 fall protection and aerial lift safety certifications.

"I think my training prepared me to get my work done correctly and efficiently but also in the safest way possible," he says. "I am continuing to learn and grow my skillset by staying up to date on the Code and always keeping an open ear to suggestions and tips from my elders in the trade."

Heidenreich says he's open to constructive criticism.

"I think what it takes to succeed as a young employee in the electrical industry today is hard work, dedication, and being willing to learn," he says.

As a fourth-year apprentice, some of his key responsibilities are running the lights, office rough-ins, running conduit, and assisting his superintendent and foreman.

"One of my favorite things about my current role is helping to get the project done," he says. "Seeing the finished product is very rewarding."

He is currently mounting transformers and panels and running conduit for the exit light , exhaust fans, and louvers for the Behr Paint Distribution Project. In the future, he says he plans to work his way up to a foreman.

"I plan to run jobs. To reach that goal, I will continue to work hard and learn as much as I can," he says.

EC&M ALL STARS 2023 UNDER 30

DYLAN HEWITT

Job Title: Estimator
Company: Compass Electrical Solutions
Location: St. Louis
Age: 28; **Years on the Job:** 8
Interests: Being outdoors, camping, hiking, fishing, going to the gym, playing pickleball, going on walks, and playing with his two dogs

With a father as an electrician for a printing company, Dylan Hewitt remembers walking through the plant at a very young age.

"I remember seeing all of the massive machines operating all around me," he says. "I was always amazed at the fact my dad was the one responsible for energizing the machines and making any repairs whenever a press would break down. That amazement grew into curiosity, and I understood more and more the opportunities that the electrical industry can afford."

Born and raised in St. Louis, he earned his associate's degree in electrical systems design from Ranken Technical College. He worked as an apprentice electrician between his first and second year of schooling.

"I got a hands-on perspective to understand how all of the parts and pieces come together to form a successful project, how to interact with the other trades on site, and the flow of construction," he says. "Those are not things you can always get from the classroom."

To succeed in the electrical industry, he says you must take pride in your work, have a good attitude, meet other professionals in the industry, and listen to the customer.

"Whenever you take pride in your job, others will recognize your hard work, and your reputation will precede you," he says.

When he first started at Streib Co., he performed takeoff on construction prints as a junior estimator. After eight years, he served as the electrical estimator for his company's alternative energy department. He recently joined a new electrical contractor, Compass Electrical Solutions. Down the road, he hopes to continue to grow and expand on his knowledge.

"I want to help lead a younger generation to be successful in the electrical industry," he says.

Dylan Hewitt learns about new technology by seeking out trade shows, talking to vendors about new products, and asking electricians what works best for them in practice.

STEEL BOX WITH BRASS COVER

LISTED SINGLE GANG FLOOR BOX KITS

CONVENIENT, FLUSH-TO-THE-FLOOR RECEPTACLE INSTALLATION

FLB5331NL
Single gang
steel box kit
w nickel-plated brass cover

FLB5331MB
Single gang Kit
w brass cover

Arlington® 800/233-4717 • www.aifittings.com

Arlington's **STEEL FLOOR BOX KITS** give installers a low cost, *convenient* way to install a receptacle *in a new or existing floor*.

Our Listed Single Gang Steel Floor Boxes deliver easy, flush-to-the-floor installation.

- Brass covers hide miscut flooring; gaskets prevent water intrusion; flip lids protect the box when it's not in use.
- Single gang brass and nickel-plated **Brass Covers** fit our boxes *and other manufacturers' single gang boxes.*

Covers also sold separately.

FLB5331MB
Single gang
steel box kit w brass cover

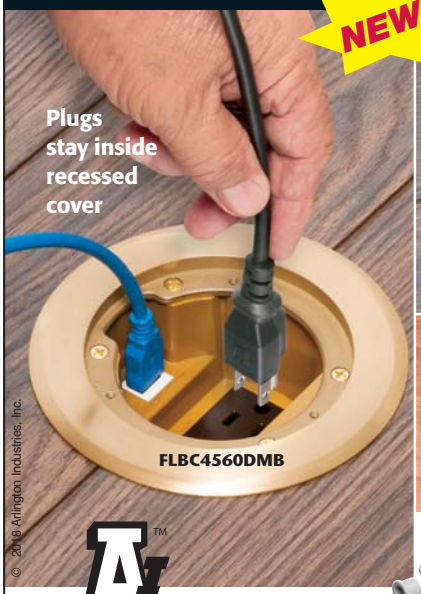
for NEW or existing floors

c UL us

Product info aifittings.com/landing/flb5331-flb5551-kits

IN BOX® RECESSED COVER KITS

INSTALLS INSIDE 4.5" CONCRETE BOXES



NEW!

c UL us

Arlington® 800/233-4717 • www.aifittings.com

Arlington's **IN BOX® Recessed Cover Kits** are the neat way to install a receptacle in an installed 4.5" concrete floor box, *including our FLBC4500 or FLBC4502 boxes.*

IN BOX covers install fast, *inside the can* reducing trip hazards caused by plugs sticking out of the box. They look great. And, you can have power and low voltage in the *same* box.

Assembled IN BOX, comes with matching in-use slotted cover and cover blank for unused boxes in **brass** or **nickel-plated brass**

...and **plastic** in FIVE colors.

Product info aifittings.com/landing/inbox-cover-kits/

Darien Hudson has completed more than 80 licenses, certifications, and training programs during his career.

DARIEN HUDSON

Job Title: Senior Estimator
Company: Amteck, LLC
Location: Lexington, Ky.
Age: 26; **Years on the Job:** 8
Interests: Spending time with friends and family, going to the gym and lifting weights, doing mixed martial arts, riding motorcycles, reading, and being in nature

Darien Hudson came from a family of loggers and always enjoyed working with his hands. Raised by a single mother of two, he knew college was not an option. A tour of the local vocational school during his sophomore year of high school, however, changed his life.

"I was very interested and decided to start taking classes my junior year," he says. "I loved the work and material and decided to make a career out of it."

Born in Booneville, Ky., he attended two years of vocational schooling at Lee County Area Technology Center and graduated from Amteck, LLC's apprenticeship program. He then earned his associate's degree of applied science from Gateway Community and Technical College and a bachelor's degree in construction management from Indiana State University. He is currently attending Purdue University for a master's of science degree in construction management technology.

In addition to serving as a senior estimator at his company, he is also the apprenticeship and continuing education instructor at Associated Builders and Contractors (ABC) and an adjunct instructor at Bluegrass Community and Technical College (BCTC).

At ABC, he hosts evening classes for apprentices and teaches a lab-based curriculum. On the weekends, he teaches continuing education classes for licensed contractors, journeymen, and master electricians. At BCTC, he teaches online courses to electrical technology students.

He hopes to one day serve as the active director of estimating or the pre-construction manager for his company. He also plans to continue his educator roles.

"I am fortunate to work with some of the brightest and most quality people in the industry and have students that are enthusiastic and excited to be entering the industry," he says.

EC&M ALL STARS 2023 UNDER 30

DAVID INIGUEZ-ROJO

Job Title: Leadership Development Associate
Company: Henkels & McCoy
Location: West Sacramento, Calif.
Age: 25; **Years on the Job:** 1
Interests: Running long distances, training for a marathon, and traveling/visiting new places with friends and family

David Iniguez-Rojo worked as a custom home painter before entering the electrical industry.

"We would work in brand new homes while they were getting built, and that is where my love for construction started," he says.

He got interested in working in the electrical industry after his father joined the IBEW Local 1245 union and started working for Henkels & McCoy.

"He would tell me all the interesting construction projects that they were working on, and I would get so intrigued in the stories he would tell me," he says. "The day I stepped into my first substation was the day I knew I wanted to be in the electrical industry for the long haul."

Born and raised in a small town two hours north of Sacramento, Calif., he earned his bachelor's degree in economics from Sacramento State University. Before transitioning to his current role as a leadership development associate, he worked as a field engineer. He is now in his project controls rotation. Down the road, he plans to work as a foreman for an electrical construction firm.

"I truly have a passion for construction and the art of building, and I would like to go back out into the field and start learning this trade but from the hands-on side of things," he says.

He says he'd like to thank the team and his mentors for their support and for nominating him for the 30 Under 30.

"Without them, I would not be in the place I am today, nor would I be learning at the pace that I am," he says. "I have a lot more to learn and am excited about where my journey will take me as well as being a part of an industry that helps power the world."

David Iniguez-Rojo is working on two key projects including the construction of substations in Santa Clara, Calif., and Pearl City, Hawaii.

LISTED • LOOKS GREAT • SAVES TIME

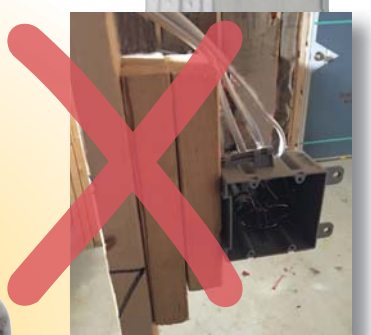
ADJUSTABLE SLIDERBAR™

NOW WITH FLAT BRACKETS

SL24F
fits 15"-24" spacing

SL18F
fits 12"-18" spacing

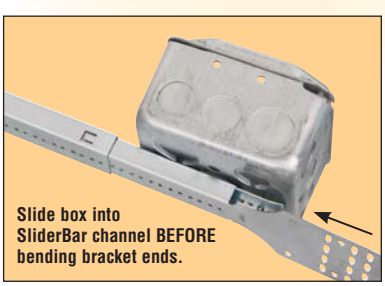
Patent pending



SAVES 20 MINUTES PER BOX

The NEAT Way to Mount Single or Two-gang Metal and Plastic Boxes

Attach mounting bracket to box.



Slide box into SliderBar channel BEFORE bending bracket ends.

Bend SliderBar bracket ends 90°. Bend ends again along guides to desired wall board thickness.

Here's the easy way to mount single *or two-gang* boxes between wood *or metal studs* with non-standard stud cavities.

Arlington's steel **SliderBar**™ looks great and ***saves about 20 minutes per box*** over cutting, nailing and placing extra 2x4s! *It's available in two styles – with pre-bent brackets – or FLAT BRACKET ends. And in two adjustable sizes for studs spaced 12 to 18 inches – or 15 to 24 inches apart.*

The extra convenient SliderBar with FLAT brackets comes with a steel mounting bracket for installing almost any metal box, and our plastic SLB101 and SLB102 boxes, on the bar anywhere in the stud cavity.

Use the SL18BKT mounting bracket.to add another metal box on FLAT SliderBar.

Metal boxes mounted on SliderBar are rated for non-metallic and MC, AC and Flexible Metal Clad cable

- **Guides on bracket ends** assure proper positioning on studs
- **Interlocking tab stop** prevents accidental disassembly
- **Pre-punched pilot holes** on BOTH sides of SliderBar allow for easy attachment of boxes

c UL us

SL18F FLAT SLIDERBAR KIT Adjusts to fit between studs, 12" to 18" o.c.

SL24F FLAT SLIDERBAR KIT Adjusts to fit between studs, 15" to 24" o.c.

SL18F, SL24F include flat SliderBar, steel mounting bracket, (2) #8 x 1/2" screws

SL18BKT Steel Mounting Bracket w mounting screws

SLB101 PLASTIC BOX Single gang • pre-formed screw holes

SLB102 PLASTIC BOX Two gang • pre-formed screw holes

Arlington™

Arlington®

www.aifittings.com Scranton, PA 18517 **800/233-4717**

Product info aifittings.com/landing/sliderbar

Spencer King has managed seven of the substation sites for the Southern Illinois Reliability Project for Ameren since the project's inception in 2019.

SPENCER KING

Job Title: Senior Project Manager
Company: ArchKey/Sachs Electric
Location: St. Louis
Age: 28; **Years on the Job:** 7
Interests: Spending time with his wife and daughter, boating, hunting, and fishing

The introduction of LEDs in the consumer market sparked Spencer King's interest in working in the electrical industry.

"I have always been fascinated by the flow and theory of electricity," he says.

His dad, who owns a floor-covering business, has been self-employed for nearly 40 years, and he worked with him every chance he could get growing up.

"He showed me the importance of a hard work ethic and gave me a lot of hands-on skills I am proud to have today," he says.

King, who was grew up in Carlyle, Ill., graduated from Ranken Technical College with an associate's degree in electrical systems design technology. After graduating, he started his career as an engineering technician in the electrical department with Black & Veatch in Overland Park, Kan. During the two years he worked for the company, he was mainly involved with oil and gas projects.

His training helped him to hit the ground running when he started as an assistant project manager with Sachs Electric. At the time, he was relatively new to utility and substation projects, and it was his first management position.

"I adapted quickly and soon became fond of construction processes and working directly with our customers," he says.

Recently, he has focused his learning on making safety initiatives. In March, he earned his certificate from the Board of Certified Safety Professionals as a safety-trained supervisor-construction, and in April, he completed the OSHA 20 Hour, ET&D Leadership training geared toward supervisors in utility construction.

After 11 years in the industry, he was recently promoted to senior project manager. He enjoys facilitating and enabling crews to be safe and successful.

"I really enjoy seeing the project develop from the estimate stage to above-ground completion," he says. "Seeing the finished product really becomes a proud accomplishment for my team."

SIDNEE LARGENT

Job Title: Project Coordinator
Company: Henkels & McCoy
Location: San Diego
Age: 25; **Years on the Job:** 1
Interests: Snowboarding, hiking, camping, fishing, and spending time in the mountains

When Sidnee Largent had the chance to work in the electrical trade, she jumped at the opportunity.

"I literally fell in love with the fast pace and puzzle-like job tasks I was given," she says.

Born and raised in California, she attended college for a year to study radiology. After her path changed, much of her formal training was done on the job with support from her colleagues and management personnel at Diversified Utility Services.

After coming on board at Henkels & McCoy as a project coordinator, she is now starting to assist with the Quality Control department in closing out all distribution and transmission jobs to submit to San Diego Gas & Electric (SDG&E).

"I am learning so much on the field side of operations that I know will benefit me in my career in the industry," she says.

As a project coordinator, she starts her day early in the morning out in the yard or in the office. Her key responsibilities are verifying timesheets with subcontractor tickets to prep for billing, receiving all new job packets from SDG&E, printing and prepping them for the field, and closing out all jobs with quality control.

"Now that I am slowly transitioning to the QC department, my responsibilities have multiplied exponentially," she says. "I work closely with my project manager and general foreman to facilitate smooth operations."

Her favorite and most challenging parts of her job are one and the same, she says.

"The fun and excitement of my role is when my colleagues and I collaborate together to solve critical problems in urgent situations," she says.

She sees herself in a management position or running projects down the line.

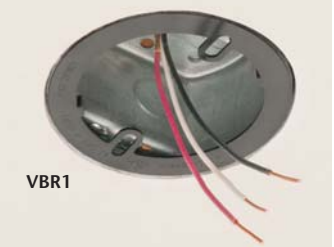
"I want to learn as much as I possibly can to position myself to run successful projects and help my team in producing quality work," she says.


Sidnee Largent says she's honored to be part of the 30 Under 30 and excited to see what her future holds.

ARLINGTON'S ECONOMICAL VAPOR BARRIER COVERS Made in USA

PREVENT AIR INFILTRATION

AROUND STEEL AND PLASTIC BOXES • *WITHOUT A GASKET*



Round or Octagonal ceiling boxes

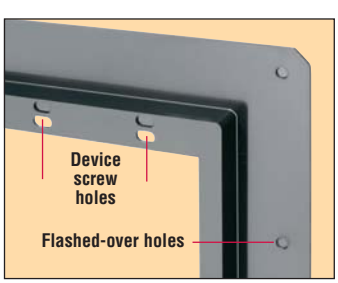
Single and Multi gang boxes

For help Obtaining ENERGY STAR rating

Arlington's vapor barrier covers prevent air infiltration around single, *and* ***NOW two-*** *and* ***three-gang outlet boxes*** *and* ***round and octagonal ceiling boxes,*** **without the need for a gasket.**

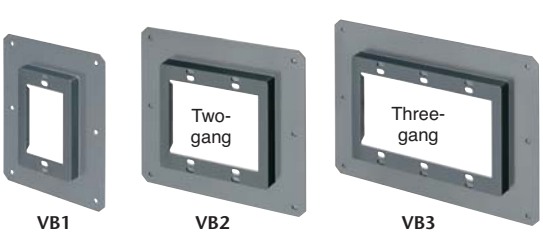
Installation is easy. Two screws hold the vapor barrier cover *temporarily* in place during the installation of 1/2" or 5/8" drywall, through the device screw holes or the flashed-over holes in the flange. After the drywall's installed remove the screws, *if using the device screw holes,* and install the device.

Designed for new work, VB1 and the **new VB2**, **VB3** and the round **VBR1** install on most plastic or steel boxes.



Arlington™

c UL us



VB1 VB2 VB3

for single-gang round or octagonal boxes

www.aifittings.com Scranton, PA 18517 **800/233-4717**

Product Info aifittings.com/landing/vb1

Jordan Latimer enjoys the constant variation of his job and what he accomplishes at the end of each work day.

JORDAN LATIMER

Job Title: Foreman
Company: Hill Electric Co.
Location: Anderson, S.C.
Age: 28; **Years on the Job:** 9
Interests: Fishing, rebuilding old gas pumps (just like his dad), and spending time with his wife

Jordan Latimer has always enjoyed working with his hands and piddling with electronics. He was introduced to Hill Electric through his friends at the fire department.

Born and raised in Belton, S.C., he started to work for Hill Electric following high school graduation and received on-the-job training. He says mentors at his company have helped him to prepare for his current position as a foreman.

"The assignment I have been at for the past few years offers me continuous learning through the constant variation of installations," he says. "The installations at my job site go from large power feeders and distribution to machine devices and controls."

Latimer says he's proud to represent the skilled trades of South Carolina as part of the 30 Under 30. As a young employee and supervisor, he says it's important to lead by example.

"If you jump into an installation and set the pace and engage, the rest of the group will follow," he says. "You can set expectations by your own actions."

As a job-site foreman, he is responsible for communication to the customer, performance of the crew, management of material/equipment, and quality of the installation.

"When I started, I was responsible for my own actions and installation," he says. "Now I am responsible for the actions and installation of others."

Hill Electric is currently performing the electrical installation for a new warehouse expansion and preparing for a large horsepower motor and drive changeout during an upcoming outage. Latimer says he sees himself continuing to work for the company.

"I am comfortable in my role as a site responsible lead, but I am still working on what my next steps are," he says. "I enjoy the management level I'm at and want to be sure I am fully ready before moving to the next level."

PATRICK LOCKE

Job Title: Area Foreman
Company: Alterman, Inc.
Location: Austin, Texas
Age: 28; **Years on the Job:** 9
Interests: Spending time with family and friends, fishing, hunting, beekeeping, and creating memories with his wife and two children

Patrick Locke hails from a family of Union electricians, and his interest in the electrical industry developed at a young age.

"My father, Glenn Locke, to this day is a dedicated and diligent electrician, who has guided me in my journey in this field," he says. "My grandfather, Roy Locke, also a former Union electrician, passes on knowledge, skills, and guidance about the history of the electrical industry."

Born in Clarksville, Tenn., and raised in Austin, Texas, he enrolled in the Joint Apprenticeship and Training Committee's five-year apprenticeship program following high school graduation. During his apprenticeship, he learned how to understand theory and basic electrical knowledge and prepared to pass the state journeyman exam.

Every day, he is faced with opportunities in the field that allow him to learn and grow as an electrician.

"Behind the desk or hands-on in the field, performing as a foreman I hold the responsibility to keep the crew safe," he says. "This is done by modeling best practices, efficiency and holding each crew to high expectations at the job sites."

As a foreman, his responsibilities are laying out the crew on the individual task, teaching others about the trade, problem solving, ordering materials to do the job, enforcing a safe work environment, and coordinating with other trades.

He's currently working on Kalahari's water park expansion in Round Rock, Texas, and Tito's in Austin, Texas. In 10 years, he envisions himself continuing his career as an electrician.

"While at the moment I am unsure of what I want my end goal to be, my role as a foreman has provided me with experiences that I can use in the future," he says. "I am honored to be able to represent the many young electricians in this trade and pave the way for the next generation of electricians."

Patrick Locke's duties as a foreman include operating equipment, running conduit, pulling wire, installing lights, and terminating panels.

NON-METALLIC • VENTED FOR EASIER STACKABILITY

Made in USA

CONCRETE PIPE SLEEVE

THE EASY, ECONOMICAL WAY TO SLEEVE THROUGH CONCRETE POURS!

CPS40
Pipe Sleeve
for 4" hole

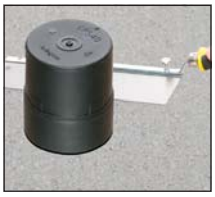
Arlington's **Concrete Pipe Sleeves** are the economical way to sleeve through concrete pours in tilt-up construction WALLS – and FLOORS *allowing cable and conduit to run easily from one floor to the next.*

No costly core drilling – No cutting holes in the form. Plus, you can position the hole prior to pouring the concrete.

- Attaches to form with nails or screws
- Stackable up to 23" h for extra deep pours
- Vents keep wet pipe sleeves from sticking together
- Multiple hole sizes: 1-1/2" • 2" • 3" • 4" • 5" • 6"

CPS40

Nail sleeve to form.



After concrete sets, cut sleeve flush with surface.

Insert conduit into sleeve.

Arlington®

800/233-4717 • www.aifittings.com

Product info aifittings.com/landing/concrete-pipe-sleeve

LOW COST • ZINC

Made in USA

MC CABLE FITTINGS

NEW SIZE!

3-1/2" THAT FIT SEVERAL CABLE SIZES

Save time and money! Arlington's low cost MC cable fittings, *for dry locations only,* are super-convenient and cost-effective. End stop bushings vary the size of the opening so *ONE trade size fits several cable sizes!*

Changing end stop bushings is fast and easy. *No need to remove the strap.* Insert the bushing that works the best with the cables you're installing.

Reduce inventory –
Costs much less than steel and malleable iron fittings

Built-in end stop

c UL us

Patented

3-1/2"
8418

8418 for **1000 Mcm wire** and **TECK90**

Catalog Number	Trade Size	Cable O.D. Min	Cable O.D. Max	Wire Bundle O.D. Min	Wire Bundle O.D. Max	Conductor size # of Conductors* (AWG/KCMIL)
8412	1"	.780	1.120	.660	1.000	6/3, 6/4, 4-3, 4-4, 2-3, 2-4, 1-3
8413	1-1/4"	1.000	1.460	.870	1.370	2-3, 2-4, 1-3, 1-4, 1/0-3, 1/0-4, 2/0-3, 2/0-4, 3/0-3
8414	1-1/2"	1.360	1.770	1.250	1.590	2/0-4, 3/0-3, 3/0-4, 4/0-3, 4/0-4, 250-3, 250-4
8415	2"	1.700	2.200	1.550	2.050	250-4, 300-4, 350-3, 350-4, 500-3
8416	2-1/2"	2.100	2.700	1.950	2.400	500-3, 500-4, 600-3, 600-4, 750-3
8417	3"	2.500	3.300	2.350	3.000	600-4, 750-3, 750-4
8418	**3-1/2"**	**3.300**	**3.600**	**3.031**	**3.500**	**750-3, 750-4, 1000-4**

NEW

* Examples of 3- and 4-conductor cables accommodated.

800/233-4717

www.aifittings.com

Arlington®

Product info aifittings.com/landing/8412

Jesse Mitchell teaches an evening class and enjoys helping the next generation of electricians with training and development.

JESSE MITCHELL

Job Title: Apprenticeship Coordinator
Company: Claypool Electric
Location: Lancaster, Ohio
Age: 30; **Years on the Job:** 13
Interests: Spending time with his wife and one-year-old daughter, hanging out with friends, and watching sports

Jesse Mitchell says his parents are a large reason why he got into the electrical industry. His father attended a high-school electrical trade program, which paved the pathway for his successful multi-craft maintenance career. His mom attended the same school at the same time, and she took a program that led her to HR and accounting roles.

"My sister and I graduated from the same trade school our parents did, and I attended the same electrical program that my father did," Mitchell says.

Born and raised in Ohio, he completed four years of electrical apprenticeship training followed by a motor controls program and an instructor certification training program.

"The training I received allowed me to develop into a critical thinking, well-rounded electrician and allowed me to succeed in many scenarios and environments," he says.

Mitchell is now attending the Builders Exchange of Central Ohio Executive Leadership Experience program and pursing his associate's degree in construction management. His job-site leadership role has grown with increased responsibility and project size, but his core values have always stayed the same.

"My philosophy has always been to train the individuals now — reap the benefits a year from now," he says. "My role allows me to focus on coaching, mentoring, and training the next generation of electricians."

As an apprenticeship coordinator, his key responsibilities are to construct, manage, and grow the 5,500-sq-ft training lab; focus on apprenticeship course content in the classroom; design/build hands-on mock scenarios. His favorite part of his job is coordinating outreach and recruiting to local high schools, trade schools, job fairs, and education centers.

"I am a product of one of these programs, and I feel that my story sits well with the students about what the trade has to offer and what Claypool Electric could provide them in their career," he says.

EC&M ALL STARS 2023 UNDER 30

PAOLA MORALES

Job Title: Assistant Project Manager
Company: Rosendin
Location: Murfreesboro, Tenn.
Age: 27; **Years on the Job:** 1.5
Interests: Spending time with family, cooking, baking, traveling, and volunteering in the community

Paola Morales, who was born and raised in Maracaibo, Venezuela, was inspired to work in the electrical trade by her dad, who worked as a supervisor for an electric utility. After graduating from high school, she immediately knew she wanted to study a subject related to the electrical field.

"Most of my uncles and aunts were engineers, so I decided to study electrical engineering," she says.

Morales, who graduated second in her engineering class from her university, completed safety and technical training sessions/courses for project management and leadership. She considers making the decision to come to the United States as the best thing she could have done for her career and personal growth.

"Coming from a different country where you don't have a lot of opportunities in the industry helped me to think out of the box," she says.

She says she worked hard to get her to the point where she is today.

"I feel so honored and proud of being able to get from a third world country all the way to this," she says. "I'm thankful for God and my family for always being there for me. If you can dream it, it can happen."

During her time at Rosendin, she has learned about all phases of a project from start-up to execution to close-out. She says teamwork is her favorite and most challenging part of her job.

In the future, she would like to serve as a project executive for her company.

"I want to be the leader, the person who other follows and inspire," she says. "I'll work hard and do everything I have in my power to make it happen."

As an assistant project manager, Paola Morales is responsible for document control, submittals, material tracking, and pulling weekly reports on the financials of all the projects in Tennessee, Arizona, and Texas.

STAINLESS STEEL • POP UP COVER

FLOOR BOX KITS

EASY RECEPTACLE INSTALLATION • *NO DISASSEMBLY!*

Cover closes flush

FLBT7200BL
Black stainless steel cover

FLBT7200SS
Stainless steel cover

Arlington's **Pop-up COVER/BOX KITS** provide options for installing a device in a floor – or a countertop!

The kits include a 20A receptacle OR you can install one of your own. It's *easy.*

The device installs from the front. There's no need to dismantle the hinge mechanism. Just remove the white cover plate, install the receptacle and replace the cover plate.

c UL us
Listed as floor box

Gasketed stainless steel or black stainless trapdoor covers close flush with the surface, preventing damage to the device and minimizing trip hazards in a floor installation.

- Easy **'No Glue'** installation – the spring steel clip holds box securely against the surface when screws are tightened
- Fits surfaces up to 1-1/2" thick
- Uses standard rectangular receptacle, and GFCI, and GFCI/combination receptacles

Patent pending

Arlington™

www.aifittings.com Scranton, PA 18517 **800/233-4717**

Product Info aifittings.com/landing/flbt7200-floorbox-kits

Mark Niechwiadowicz says he is eager to learn and try new things and is quick to ask for more responsibility and raise his hand when new opportunities arise.

MARK NIECHWIADOWICZ

Job Title: Electrical Designer
Company: DLR Group
Location: Dallas
Age: 29; **Years on the Job:** 7
Interests: Staying active in recreational sports, doing yard work, hiking, cooking meals, and watching Yankees baseball with his wife

Mark Niechwiadowicz went to school for engineering based on his interest in buildings and excelling in math and science. As he studied architectural engineering, he discovered a passion for lighting design.

"I was drawn to the impact that lighting has on how we experience architecture and the space, creating mood and drama," he says.

Born and raised in Sioux Falls, S.D., he earned his bachelor's and master's degrees in architectural engineering with an emphasis in electrical and lighting design from the University of Nebraska.

"My education prepared me to directly enter the building engineering industry," he says.

Following a four-year apprenticeship under a licensed engineer, he passed the Electrical and Computer Professional Engineering Exam and became a licensed engineer in the state of Nebraska. He then pursued his passion for lighting design by passing the NCQLP Lighting Certification Exam.

"My engineering licensure was critical in preparing me for my role as an electrical engineer and team leader," he says.

In his current role as the regional electrical engineering leader, his responsibility is to manage the electrical engineering staff and facilitate all electrical engineering work in Texas.

"In my role, I enjoy leading many exciting projects," says Niechwiadowicz, who is serving as an electrical design leader and engineer of record on the new Football Operations Center at the University of Houston. "I am always rewarded to see a project completed."

While it's been a challenge to adapt from a doer to a delegator, he likes to empower other team members to take on tasks and have ownership in the design process. In five to 10 years, he wants to see the electrical engineering team grow to 12-plus team members and expansion into the Austin and Houston office.

"I want to be more involved with our project pursuits and interviews with large clients to win work," he says.

DANIAL OKHOVVAT GILANI

Job Title: Project Lead Engineer
Company: M.C. Dean
Location: Tysons, Va.
Age: 26; **Years on the Job:** 4
Interests: Playing water polo, working out, and creating things with what he's learned from school and work

After studying electrical engineering at Virginia Tech, Danial Okhovvat Gilani was excited to apply his knowledge and understanding in the field.

"I find it extremely noble to help design and build a system or a project that can help the needs of future generations," he says.

Born in Iran, he moved to the United States in high school. He's now studying for his master's degree in power systems from Virginia Tech, and he says his training has helped him to create more effective and efficient designs and solutions.

"I have been lucky enough to be exposed to field work and see my design come to life," he says. "I hope other employees also get an opportunity to get a similar experience, as it is extremely helpful to gain a better understanding of the system and what it takes to achieve project goals."

Danial Okhovvat Gilani strives to learn about different software and promote technology that will help customers reach their goals faster and better.

As a project lead engineer, he has participated in the design, QC inspections, procurement, scheduling, commissioning testing, field installation, and financials.

"I do appreciate being exposed to so many different challenges and roles; however, sometimes managing all of them at once can be quite overwhelming," he says. "However, as George Patton said, 'pressure makes diamonds.'"

He says his company has projects with many private and federal clients, and he assists with integrating all electrical disciplines. He says technology and today's tools can help to create a more accurate design in a more timely manner.

As he progresses in his career, he hopes to be in a position to best help his team and his company to accomplish their goals — whether that be as a senior design engineer, engineer leader, or project manager.

"I'm happy to be part of this group and hope to be able to train other engineers for this team," he says.

ECONOMICAL • INTERLOCKING

GANGABLE FLOOR BOX

FOR NEW CONCRETE FLOORS

NEW COVERS!

HERE'S HOW IT WORKS...

Connections on sides lock single gang FLBC8500 boxes securely together

Lock two boxes together for a two-gang box. Add another for three-gang!

PLASTIC Listed Cover/frame kits
NOW IN PLASTIC, FIVE Colors!

Build a two- or three-gang concrete floor box by simply locking *single gang* boxes together!

Then buy the UL LISTED single, two- or three-gang cover/frame kit, *with devices included*, in **PLASTIC, FIVE COLORS** – ***or in economical diecast zinc with a brass or nickel finish***. *Fast, easy installation.*

Cover installs with hinge on either side.

UL LISTED

Made in USA

FLBC8510BR

Plastic Cover/frame Kit

Single gang
FLBC8510BR Brown
FLBC8510BL Black
FLBC8510GY Gray
FLBC8510CA Caramel
FLBC8510LA Lt Almond

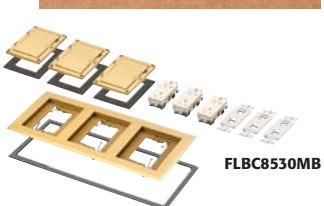
Two-gang
FLBC8520BR Brown
FLBC8520BL Black
FLBC8520GY Gray
FLBC8520CA Caramel
FLBC8520LA Lt Almond

Three-gang
FLBC8530BR Brown
FLBC8530BL Black
FLBC8530GY Gray
FLBC8530CA Caramel
FLBC8530LA Lt Almond

Arlington®

Metal Cover/frame Kit

Brass finish
Single gang **FLBC8510MB**
Two-gang **FLBC8520MB**
Three-gang **FLBC8530MB**



Nickel finish
Single gang **FLBC8510NL**
Two-gang **FLBC8520NL**
Three-gang **FLBC8530NL**

www.aifittings.com Scranton, PA 18517 **800/233-4717** Patented

Product Info aifittings.com/landing/gangable-box-kits/

MAKENNA PEARLMAN

Job Title: Journeyman Electrician
Company: Brattan Industries
Location: Leominster, Mass.
Age: 23; **Years on the Job:** 5
Interests: Spending time with family and friends, traveling, hiking, fishing, four-wheeling, and spending time with her boyfriend, Kyle; dog, Rocky; and cat, Luna

Makenna Pearlman enjoys working in the electrical trade because she's usually doing something different on every job.

Electrical wiring and the work come easy to Makenna Pearlman, who went to a trade school to train to become an electrician.

"I was able to understand the work fairly easily and quickly, and the money is also really good, so that helped with my decision," says Pearlman, who is the first in her family to work in the electrical trade.

Born in Colorado and raised in Massachusetts, she learned about basic wiring with Romex and MC and how to write wire diagrams and bend EMT at her technical high school.

During her junior year of high school, she started a two-year training co-op program with Wayne J. Griffin Electric. She also attended night school Code classes at Monty Tech and says her training with different people helped the most in her training for the trade.

"Everybody has a different mindset that can lead to more efficient and easier ways to complete a task," she says.

As a licensed electrician, she starts work at 6 a.m. and ends her work day at about 2 p.m. Before working on a large commercial project, she was doing rough-in, finish work, and underground. Now, she is focusing on conveyor work.

"My favorite role is getting to see the conveyor up and running," she says. "The most challenging part is going through the schematics and the prints to figure out device numbers and which devices go where on the conveyor."

In the future, she sees herself with a master's license and possibly owning her own company.

"I will be going back to school shortly to continue my education to go for my master's in a year," she says. "As far as my own company, I plan on figuring that part out in a few years from now when I get more settled."

EC&M ALL STARS 2023 UNDER 30

CHRIS PEOPLES

Job Title: Apprentice A3
Company: Borrell Electric
Location: Tampa, Fla.
Age: 22; **Years on the Job:** 4
Interests: Relaxing on the beach, spending time with family, riding a jet ski, and boxing/training to stay fit

Chris Peoples got interested in working in the electrical field when he realized the wide opportunities available in the field.

"There is always something new to learn and achieve," he says. "New technology is being implemented in a world that needs electricity. This keeps me interested in the electrical industry."

Born and raised in Columbus, Ohio, he moved to Tampa, Fla., after turning 18. All his training has been done in the classroom and on the job. As of right now, he is a fourth-year electrical apprentice, but on the job, he is like a foreman in training.

"I read blueprints and do layout work for me and fellow coworkers, and I always take initiative and pride with anything I do on the job," he says. "My responsibilities have changed because now I have a mindset where I'm the first on the job and the last to leave."

He says the most challenging part of his job is when he works on things he has never done before. At the same time, that is one of the most rewarding parts of the job.

His company is currently working on a new TECO Energy plant, the Imagine downtown amusement park, and the Tampa Convention Center. He is helping the electrical crew on Saturdays on the Imagine project to get the job done before the deadline.

In the future, he sees himself as a successful electrical contractor running his own jobs. He says he's grateful and thankful to be part of the 30 Under 30.

"I'm glad to be a part of such a prestigious list of young professionals," he says.

Chris Peoples says his leadership skills and willingness to find answers on his own sets him apart from other young professionals in the industry.

SNAP²IT® CONNECTORS

EASIEST CABLE INSERTION • NO TOOLS • SECURE HOLD

Fully assembled, **SNAP²IT®** fittings **handle the widest variety of MC cable *AND THE NEW MC-PCS cables.***

Compared to fittings with a locknut and screw, you can't beat these snap in connectors for time-savings!

- **Fits widest range and variety of MC cable** 14/2 to 3/3 AC, MC, HCF, MC continuous corrugated aluminum cable and MCI-A cables (steel and aluminum)...*including the new MC-PCS cable that combines power and low voltage in the same MC cable*

  ANY Snap2It Connectors LISTED for MC cable are also LISTED for MC-PCS cable! *These products offer the greatest time-savings.*
- **Fast, secure snap-on installation**
- **Easy to remove, reusable connector**
  From cable Loosen screw on top. Remove connector from cable.
  From box Slip screwdriver under notch in Snap-Tite® ring. Twist. Remove connector.

CATALOG NUMBER	DESCRIPTION Snap2It® connectors	CABLE OUTSIDE DIA (OD)
4010AST	Snap in, 1/2" KO w insulated throat	.405 to .610
5010AST	Snap in, 1/2" KO w insulated throat	.580 to .780
505010AST	Duplex Snap in, 3/4" KO w insulated throat	(2) .590 to .820
4110ST	Snap in, 1/2" KO	.525 to .705
414110ST	Duplex Snap in, 1/2" KO	(2) .525 to .640
NEW! **4141107ST**	Duplex Snap in, 3/4" KO	(2) .525 to .690

Easy to Snap into Box!

NEW! 4141107ST

Arlington®

Patented. Other patents pending.

www.aifittings.com • Scranton, PA 18517 • 800/233-4717 Made in USA

Product info aifittings.com/landing/snap2it-mc-cable-connectors

CHASE PRUITT

Job Title: Project Manager and Estimator
Company: CRB Electrical and Mechanical, Inc.
Location: Chatham, Va.
Age: 26; **Years on the Job:** 7
Interests: Enjoy spending time with his fiancé and friends, hunting, fishing, and floating the river

Chase Pruitt says he was interested in learning the trade from his uncle, who owns CRB Electrical & Mechanical, Inc.

"I'm always curious about how things work and how people do things. Once I was exposed to it, I wanted to know all I could," he says.

Born and raised in Gretna, Va., he attended a local community college to study electrical engineering, while also working part-time for CRB Electrical & Mechanical in the field. After one year, he transferred to Old Dominion University to continue his electrical engineering degree and then transferred to Liberty University. After changing his major to business administration: project management, he took online classes and then started working for CRB.

During this time, he worked full-time estimating, managing projects, and designing commercial and industrial projects while earning his college degree. He also took lighting control and design software training classes and passed his exam for his journeyman electrical license in the state of Virginia.

"My business degree in project management has been a huge asset in my day-to-day role at CRB," he says. "It really put me into the correct mindset of how to work with people and manage my time."

Chase Pruitt says he's always looking for new products such as lighting controls, switchgear configurations, and new breakers to better assist his customer's needs.

In his current position, he estimates bid spec work, budgets, prices, designs, models design-build work, and manages projects.

"My favorite part of the job is walking through the final project and thinking about all the hours spent planning and working on it from the estimate to the final inspection," he says.

By next year, he plans to have his master's electrician license for the state of Virginia followed by his contractor's license.

"There are plenty of opportunities for young people in the electrical field, but to be able to be successful, you have to push yourself to do things you may not be comfortable with to learn what you need to succeed," he says.

EC&M ALL STARS 2023 UNDER 30

ROBERTO REYES

Job Title: Electrician
Company: Interstate Electric Services Corp.
Location: Billerca, Mass.
Age: 26; **Years on the Job:** 7
Interests: Hiking, running, fishing, working out, and spending time with family and friends

After giving college a try and realizing it wasn't the path for him, Roberto Reyes says a close family friend who worked at Interstate helped him to get his foot in the door.

"I was unsure at first, but quickly fell in love with the trade," he says.

Roberto Reyes, a licensed journeyman and master electrician, has online training in estimating and project management along with OSHA certifications.

Reyes, who was born and raised in Massachusetts, completed a four-year electrical program through Gould Construction/Interstate Electrical Services. He later went on to pass his Massachusetts journeyman electrical exam. After completing a master's electrical course through The Peterson School, he went on to pass the Massachusetts master's electrical exam.

"My classroom experience with Gould and my hands-on training with Interstate has given me the knowledge and skills to install and maintain electrical systems with confidence," he says.

As a lead electrician who helps directly support the project superintendent, he works to install electrical systems on large-scale commercial electrical projects. His tasks include bending conduit, pulling wires, installing transformers, switchgear, and panels, and wiring motors and equipment.

"My responsibilities have greatly increased since I started my career," Reyes says. "I went from a position of not knowing and being told what to do and to now being able to plan, teach, and execute."

His favorite part of his current role is working closely with the apprentices to help educate them. He also enjoys supporting them in the ABC Craft Competition and serving as a judge for the SkillsUSA TeamWorks competition for local high school vocational students.

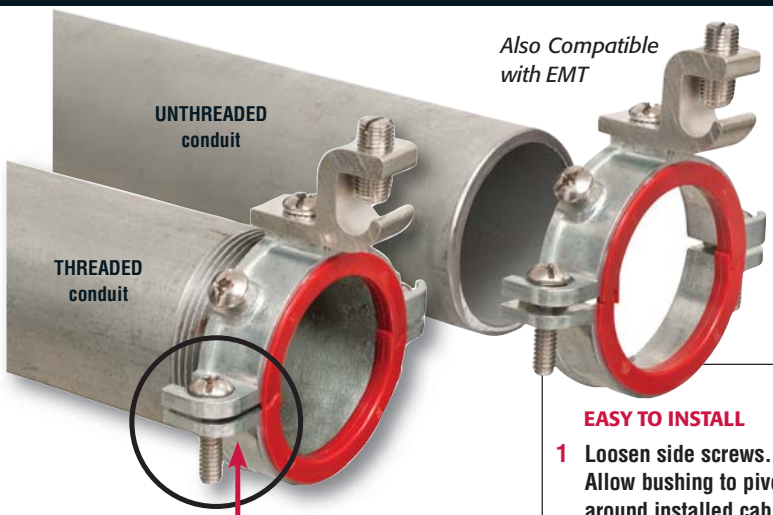
Reyes wants to continue serving as a leader in the electrical industry and inspiring other men and women in the trade.

"I see myself becoming a project superintendent and continuing to build America," he says. "I will reach these goals by continuing to work hard, educate myself, help others, and stay goal-oriented."

SPLIT GROUNDING BUSHINGS

for THREADED and UNTHREADED RIGID and IMC

EC&M Product of the Year
2023 Category Winner



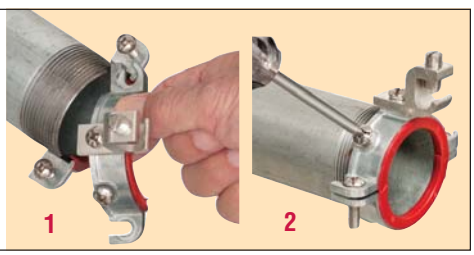
Also Compatible with EMT

Get convenience and time-savings with Arlington's 550 series **SPLIT grounding bushings**. The split allows the addition of a bushing AFTER conductors are installed in threaded or unthreaded Rigid/IMC conduit. Great for tight spaces!

- In 1/2" to 4" trade sizes – Ships Assembled
- Compatible with EMT, 2-1/2" to 4" trade sizes, and threaded electrical fittings

EASY TO INSTALL

1. Loosen side screws. Allow bushing to pivot around installed cables
2. Tighten set screw to seat bushing on conduit



Arlington® 800/233-4717 • www.aifittings.com

c UL us

aifittings.com/landing/split-grounding-bushings

NON-METALLIC

Made in USA

FIXTURE BOXES for Siding

EASY INSTALLATION

Arlington's **8141F** and **8081F** boxes deliver the fastest, easiest way to install light fixtures and receptacles on siding. *Good looks. Smooth vertical mounting!*

- Easy to install one or two-piece styles for any siding type
- NM cable connector included
- UV rated for long outdoor use
- Textured, paintable finish

ONE piece 8141F Fixture Box	VS	TWO piece 8081F Electrical Box
No extra cover to lose or store		Separate cover and box
For light fixtures		For light fixtures, standard receptacles
Costs less than 8081F		

UL CSA

Arlington® 800/233-4717 • www.aifittings.com

aifittings.com/catalog/siding-mounting-blocks/siding-mounting-block/8141F

IAN SMITH

Job Title: Electrical Engineer
Company: CDM Smith
Location: Fairfax, Va.
Age: 29; **Years on the Job:** 6.5
Interests: Traveling and photography

Ian Smith is leading the design for a new wastewater pump station and a drinking water plant upgrade.

Ian Smith has always been interested in all things electrical.

"As a kid, I was always playing with anything that used power and was also 'the button pusher,'" he says.

Born and raised in Arlington, Va., he attended Virginia Tech, where he studied electrical engineering.

"I believe the combination of a strong technical education combined with in-depth field experience has made me a much stronger engineer," he says. "I continue to grow by both researching new technologies and taking on new types of projects with new challenges, as well as continuing to work on projects in construction and address real-world issues that come up along the way."

As an electrical engineer, every work day has different work and new challenges.

"I could be working on construction services for a project in construction, the design of a new drinking water plant, a rehabilitation of a sewage pump station, conceptual design of a mega desalination plant, or an arc flash study," he says. "Each day holds something new."

His favorite and most challenging parts of his job are the variety and pace of work.

"Things are always changing, and we are always working on new and different projects," he says.

New technologies allow his company to deliver better products/solutions and eliminate tedious tasks, he says.

"I try to help us be at the forefront by being an advocate for new methods and new technologies," he says.

Five to 10 years from now, he hopes to have further expanded his technical knowledge and moved into a more technical role. He says he's honored and humbled to be a part of the 30 Under 30.

"I am surrounded by so many intelligent and inspiring people that to be selected as a 30 Under 30 is a real honor," he says.

LUKE SNOW

Job Title: Transmission Engineering Manager
Company: Toth and Associates
Location: Springfield, Mo.
Age: 29; **Years on the Job:** 7
Interests: Enjoying the outdoors with his wife and son at the lake or the farm and competing in endurance races or triathlons

Early in his engineering career, Luke Snow had no real intention of entering the electrical field. By sheer luck, he found himself engrossed in the power industry.

"I did know that I wanted a career that would provide opportunities to make meaningful impacts on my communities, create an environment of continuous learning, and allow me to work alongside great people and clients," he says. "The incredible depth and breadth of the power industry provided room to do just that."

To stay on top of best practices within the field, Luke Snow and his team are continuously reading up on, trialing, and training on new technologies within the industry.

Born and raised in southwest Missouri, he and his wife have lived in Iowa, Texas, Illinois, and Colorado for work and education, but they have settled down near his hometown. He earned his bachelor's degree in mechanical engineering from the University of Iowa before working for two mid-sized service firms in the power industry.

As an engineering manager in the transmission department, he focuses on planning, supervising, and coordinating all phases of engineering and design on projects.

"Some days, that takes the form of heavy engineering efforts on industry software for transmission, distribution, and communication design," he says. "Other days, it involves traveling to job sites to see the crews bringing life to our team's designs."

He says his job and responsibilities have completely morphed since he first started in the power industry.

"I began my career underground in the manhole systems of Chicago, inspecting for cable and structural deficiencies," he says. "Slowly, I transitioned into a more design/project management role and from underground to overhead where I now do the majority of my work."

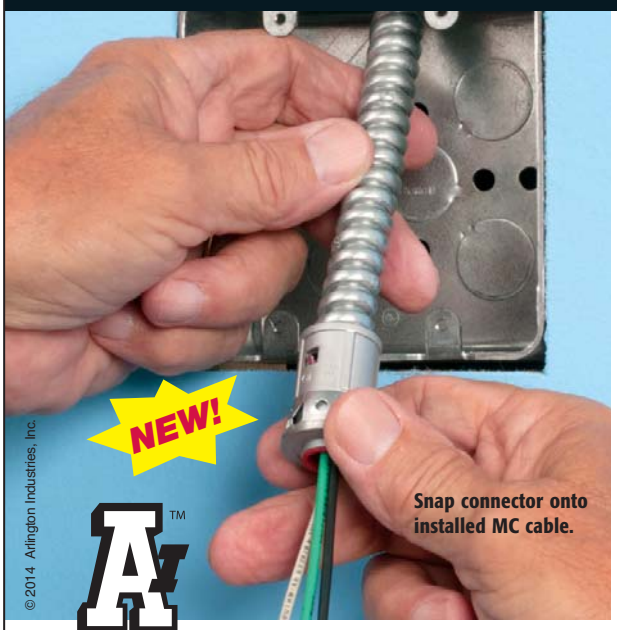
He envisions himself working with his current team in the foreseeable future at Toth and Associates. He says he enjoys the people he works with as well as those in the industry.

"Their knowledge and passion for their communities is hard to match," he says.

NO TOOLS • EASY SNAP-IN INSTALLATION • *SAVES TIME!*

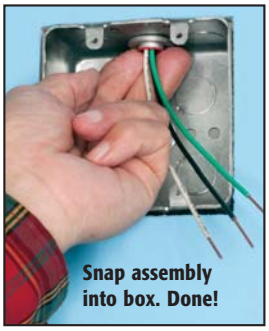
SNAP2IT® CONNECTORS

FOR RETROFIT INSTALLATIONS



Arlington's new one-piece **RETROFIT SNAP2IT®** fittings are *easy to use in an OLD WORK installation*, and handle the widest variety of cables! They're ideal for adding additional circuits to a load center. And you get the same labor-savings in a retrofit installation!

Easy snap-in installation - NO TOOLS. Install connector into the knockout in an ***existing* box**, pulling cable/conduit through the knockout. Slip the fitting onto the cable, then snap the assembly into the box. That's it... a secure installation with *no pullout*.



Patented

Widest total cable ranges 14/2 to 10/3
Widest variety of cables AC, MC, HCF, MC continuous corrugated aluminum cable, MCI-A cables (steel and aluminum), AC90, ACG90 and FLEX

Arlington® 800/233-4717 • www.aifittings.com

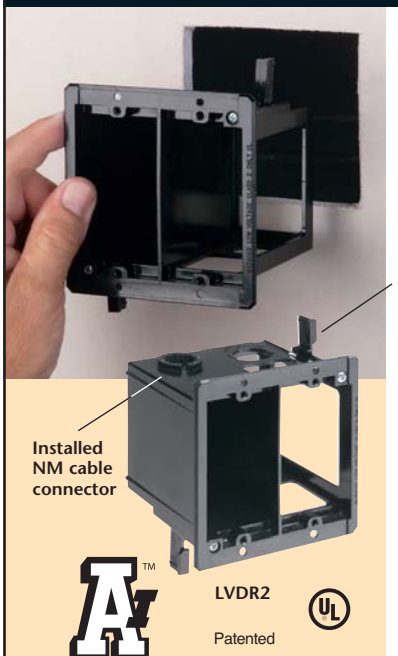
Product info aifittings.com/landing/38rast-40rast/

c UL us Made in USA

POWER & LOW VOLTAGE

COMBO BOX

FOR RETROFIT PROJECTS



This convenient combo box has power and low voltage openings in the *same box* for a neat, time-saving installation.

The box adjusts to fit wall thicknesses from 1/4" to 1-1/2". Mounting wing screws hold it securely in place.

- 2-Hour Fire Rating
- Low voltage side has a combo 1/2" and 3/4" KO for raceway
- Includes NM cable connector (power side)

Product info aifittings.com/landing/combo-boxes

Arlington® 800/233-4717 • www.aifittings.com

LOWEST COST • L-SHAPED Made in USA

FAN/FIXTURE BOX

SECURE MOUNTING TO SINGLE, DOUBLE JOISTS

Super-secure installation! Our lowest cost, L-shaped fan/fixture box mounts to single or double joists with a captive center screw.

No loose parts! Installation screws ship captive, ready to install box and bracket.

- For 1/2" or 5/8" drywall
- Fast, easy installation
- Locator posts assure proper positioning of fan/fixture bracket
- 2-hour Fire Rating

Patented

Product info aifittings.com/landing/joist-mount-fan-fixture-box

Arlington® 800/233-4717 • www.aifittings.com

DEAN WEDEKING

Job Title: Project Electrical Designer
Company: Randall Lamb Associates
Location: San Diego
Age: 25; **Years on the Job:** 3
Interests: Rock climbing, going to the gym, playing video games, and spending time with his fiancée

When he was growing up, Dean Wedeking remembers his father working as an electrician in San Diego.

"I got a lot of exposure to the field in general growing up, and I eventually decided to join the design side," he says.

His first exposure to engineering was in his high school's "Project Lead the Way" program. He then served as an intern at Randall Lamb, where he landed a full-time position after graduating with his engineering degree from San Diego State University.

"All of my training as an intern directly applied to my career with the company," he says.

Wedeking is now responsible for designing and drafting plans.

"Compared to when I first started as an intern, things are very different," he says. "I have much more freedom to design projects now."

He is also overseeing other employees and delegating tasks, which is new to him in his current role. His favorite part about his position is the variety of projects.

"I could go from designing a top-secret, 60,000-sq-ft lab building to documenting existing conditions for a retaining wall renovation, or anything in between," he says. "Every project is a different puzzle to piece together, and I love that about what I do."

Dean Wedeking says he's honored to be selected in the 30 Under 30 and tries to keep his head down and work hard in his role as an engineer.

As the lead designer for a large lab building on a military base, he is now responsible for the majority of the drafting and design for the project, attending/leading meetings, reviewing submittals, and coordinating with all the disciplines. Looking ahead, he would like to work as a principal at Randall Lamb.

"That has been my goal since I started here, and I have not wavered from that so far," he says. I think I am on the right track to get there starting with passing my PE exam this year and continuing to learn and grow within the company."

MOHAMMED ZULFIKAR

Job Title: Electrical Design Engineer
Company: P2S
Location: San Diego
Age: 29; **Years on the Job:** 5
Interests: Analyzing the stock market and making healthy dishes

Mohammad Zulfikar, an electrical design engineer, has a profound fascination with technology and its applications in electrical systems.

"As a dynamic and challenging field, it requires creativity, innovation, and problem-solving skills and a wide range of career opportunities," he says. "This is appealing to me, as it provides a chance to grow both personally and professionally."

Mohammed Zulfikar says his education and ongoing commitment to learning and growth have been essential in preparing him for his current position and will continue to drive his success in the electrical engineering industry.

As the first in his family to work in the electrical industry, Zulfikar attributes his introduction to the discipline to his professors at the Birla Institute of Technology and Science in Dubai. He earned his bachelor's degree in electrical and electronics engineering and a master's degree in electric power from the University of Southern California.

"My training has equipped me with a solid understanding of the fundamental concepts of electrical engineering and the ability to apply them to real-world problems," he stated.

Zulfikar's specialized focus on power engineering and energy-efficient solutions gained through his master's degree allows him to contribute meaningfully to his company's sustainability efforts. He explains, "I see myself leading teams and projects, working on innovative and sustainable solutions for clients, and contributing to the growth and success of my company."

Currently serving as the lead electrical designer for an aquatics center project, his responsibilities include project-specific electrical technical drawings, performing feasibility studies, and preparing schematic designs and construction documents.

He emphasized the need to stay at the forefront of the latest tools and technologies. He expressed interest in participating in P2S incubator initiatives focused on technological advancements.

Looking ahead, he aims to take on greater responsibilities and leadership roles and expand his skill set.

"I aim to make a meaningful impact in the industry and be recognized as a leader and expert in my field," he says.

ADJUSTABLE BRACKET • FOR NEW CONSTRUCTION

FAN/FIXTURE BOX

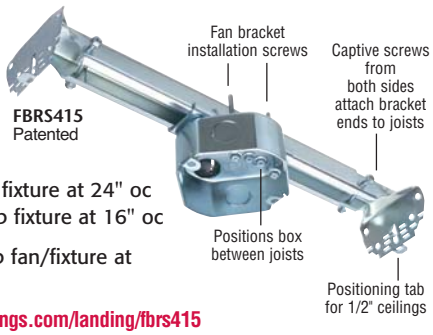
FLUSH CEILING INSTALLATIONS

Arlington® 800/233-4717 • www.aifittings.com

Arlington's heavy-duty, plated steel fan/fixture box has an adjustable bracket that mounts securely between joists spaced 16" to 24" o.c.

Flush ceiling installations
FBRS415 is designed for ceilings up to 1-1/4" thick. For 1/2" ceilings, use the pre-bent positioning tab. For other ceiling thicknesses, bend along the appropriate score line.

- 15.6 cu. inch box ships with captive screws, mud cover, installed NM cable connector



UL ratings
70 lb fan/90 lb fixture at 24" oc
70 lb fan/150 lb fixture at 16" oc

CSA rated 50 lb fan/fixture at 16" and 24"

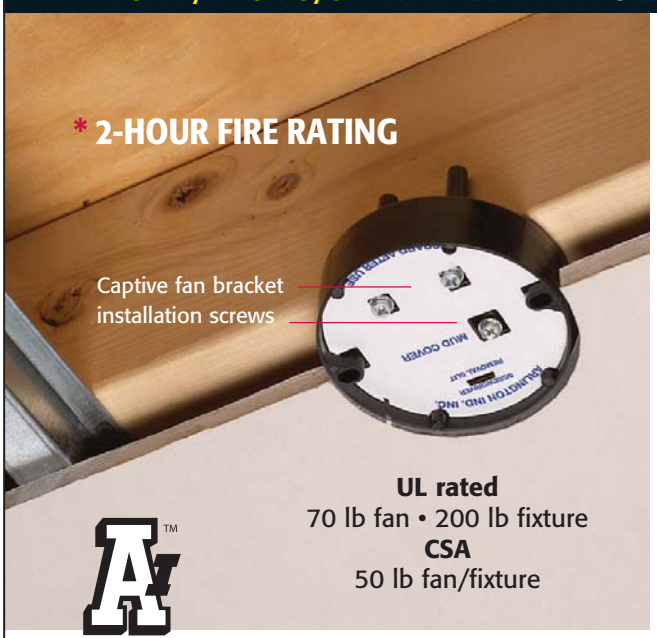
Product info aifittings.com/landing/fbrs415

SECURE, JOIST-MOUNT INSTALLATION

Made in USA

FAN/FIXTURE PAN BOX

FOR 1/2" OR 5/8" DRYWALL WITH FURRING STRIPS OR HAT CHANNEL



UL rated
70 lb fan • 200 lb fixture
CSA
50 lb fan/fixture

Arlington® 800/233-4717 • www.aifittings.com

Arlington's convenient fan/fixture pan box works with 1/2", and single *or double* 5/8" drywall – *on furring strips or hat channel.*

- Easy mounting in new work
- Fan bracket installation screws ship captive until ready for use
- Secure joist-mount installation
- 14.4 cu. in. **UL/CSA Listed**

Patented

A Deep Dive Into Article 680

Understanding equipotential bonding requirements for swimming pools, fountains, and similar installations as outlined in Art. 680 of the NEC

By Vince Della Croce, Siemens Smart Infrastructure USA

Author's Note: The 2023 NEC contains significant changes to Art. 680 Swimming Pools, Fountains, and Similar Installations. These changes incorporated public input and comments submitted during the revision cycle as well as a recent tentative interim amendment (TIA) issued by the NFPA Standards Council. TIA 23-9, issued on March 21, 2023, with an effective date of April 10, 2023, revised the definition of a pool while also changing requirements in Sec. 680.26 Equipotential Bonding.

Article 680 of the NEC provides installation guidance associated with various types of pools, spas, tubs, bathtubs, and lifts. The Article is divided into eight parts. Part I contains general requirements that describe the overall scope of the Article. Parts II through VIII provide Code users with general requirements that pertain to their specific type of installation.

To properly apply Code requirements, it is essential to understand various defined terms located in Art. 100 of the 2023 NEC. For instance, "permanently installed pools" are now defined as those that are constructed or installed in the ground or partially in the ground. This also includes all pools installed inside of a building — whether or not served by electrical circuits. Note the revised NEC edition no longer specifies that the pool must hold water in a depth greater than 42 in. A "fountain" is described as an ornamental structure or recreational water feature where one or more jets or streams of water are discharged into the air. A "splash pad" is described as a type of fountain intended for use by pedestrians and designed to contain a maximum of 1 in. of water. Additionally, the definition of a "pool" has been revised to exclude bodies of water such as lakes, lagoons, surf parks, or other natural or man-made bodies of water that may include swimming areas.

NON-METALLIC

Made in USA

THE SCOOP™

ENTRANCE PLATES, HOODS, DEVICES

The SCOOP™ series of reversible, non-metallic ENTRANCE HOODS, PLATES AND DEVICES protect cable while delivering good looks and installation versatility. They also reduce labor and eliminate extra connections.

Our newest **CABLE ENTRY DEVICES** come with *or without* a wall plate for efficient cable management. **HOODS** for decorator-style wall plates, single and two-gang **PLATES** install facing in or out...and save time!

- Low voltage cable protection
- Best way to run cable

CED130
entry device
w slotted cover

Arlington® 800/233-4717 • www.aifittings.com

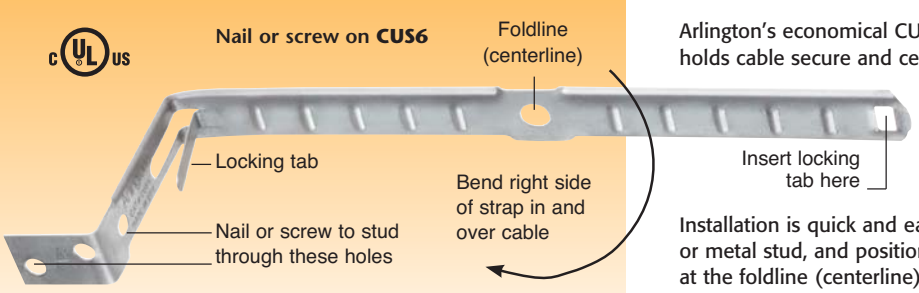
Product info aifittings.com/landing/scoop-series/

GALVANIZED STEEL

Made in USA

NEW CABLE SUPPORT

ECONOMICAL...HOLDS UP TO FOUR MC CABLES • EASY TO INSTALL



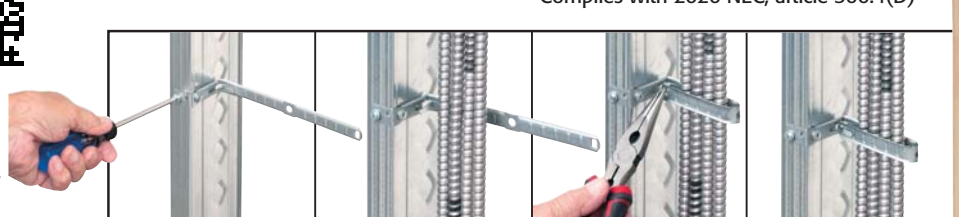
Arlington's economical CUS6 galvanized steel Cable Support holds cable secure and centered on a metal or wood stud.

It's perfect for fastening and positioning *up to four* individual metal clad cables – or six NM cables on a 2x4.

Installation is quick and easy. Nail or screw ***CUS6*** to a wood or metal stud, and position the cables. Next bend the strap at the foldline (centerline). Fold the strap over the cables and insert the locking tab in the opening as shown to hold them securely in place.

- Complies with 2020 NEC, article 300.4(D)

Holds up to four MC cables centered on a 2x4!



CUS6 holds **FOUR metal cables**...or **SIX NM cables**

Arlington® 800/233-4717 • www.aifittings.com

Product info aifittings.com/landing/cus6/

Photo courtesy of Donny Cook

Example of a permanently installed pool.

Section 680.50 of Part V provides guidance that fountains having water common to a pool and splash pads must comply with the equipotential bonding requirements. Specific information relating to equipotential bonding requirements is found in Sec. 680.26 of Part II, which addresses permanently installed pools. Please note that for the remainder of this article, the word "pool" will be used as an all-encompassing term that includes a permanently installed pool, fountain with water common to a pool, and splash pad — all of which require equipotential bonding in compliance with Sec. 680.26.

Photo courtesy of Vince Della Croce

Structural metallic wall panel of a permanently installed pool, per list item (3).

DEEP DIVE INTO SEC. 680.26 OF PART II

Section 680.26 indicates that equipotential bonding shall be installed to reduce voltage gradients in the pool area. Voltage gradients, which can also be described as the difference in voltage between the conductive parts associated with a pool found in Sec. 680.26(B)(1) through (7), can exist for a variety of reasons. The premises wiring system of a structure can leak voltage to the ground and conductive pool parts when not installed, maintained, or grounded in compliance with industry codes and standards. Electric utilities can also cause voltage gradients by leaking voltage into the ground due to conditions such as compromised insulation or ground paths. Residual voltage from lightning strikes as well as static electricity can also create voltage gradients in the pool area.

The requirement to install equipotential bonding and connect all the conductive parts described in (B)(1) through (7) together mitigates the voltage gradient by putting these parts at the same voltage potential. Although the voltage is not eliminated, connecting all the conductive parts together distributes the voltage evenly — and thus greatly reduces the likelihood of someone getting shocked. All conductive parts in (B)(1) through (7) must be bonded together by using one of three options (either separately or in combination): a solid copper conductor, no smaller than 8 AWG that can be insulated, covered, or bare; a rigid metal conduit of brass; or another identified corrosion-resistant metal.

Note the purpose of equipotential bonding differs from that of grounding and bonding to comply with Art. 250 requirements. Sections 250.4(A)(2) Grounding of Electrical Equipment and (3) Bonding of Electrical Equipment distinguish this difference. Grounding is installed to limit the voltage imposed by lightning, line surges, or unintentional contact with higher voltage lines. Bonding is installed to establish an effective ground-fault current path back to the source. Additionally, Sec. 250.52(B) states that the pool structure and structural rebar is not permitted to be used as a grounding electrode.

List item (1) in 680.26(B) addresses the conductive pool shell and provides two bonding options: structural reinforcing steel or a copper conductor grid.

RECESSED FOR FLUSH-TO-THE-WALL MOUNTING OF LED, HI-DEF TVs

STEEL TV BOX™ KIT

COMBO BOXES FOR USE WITH METAL RACEWAYS

Arlington's recessed STEEL combination power/low voltage **TV BOX**™ is the best way to mount an LED or Hi-Def TV flush against a wall.

TV BOX provides power and/or low voltage in one or more of the openings. Plugs and connectors stay inside the box, without extending past the wall.

Designed for use in new or retrofit *commercial construction* where metal raceway is used, we have a STEEL TV BOX for almost any application!

- Steel box; non-metallic paintable white trim plate
- Easy, secure installation
- Optional covers

NEW WORK
Mounting screws hold box on stud

2-GANG
TVBS505

Patented

3-GANG
TVBS507

NEW!

1-GANG
TVBS503

Arlington® 800/233-4717 • www.aifittings.com

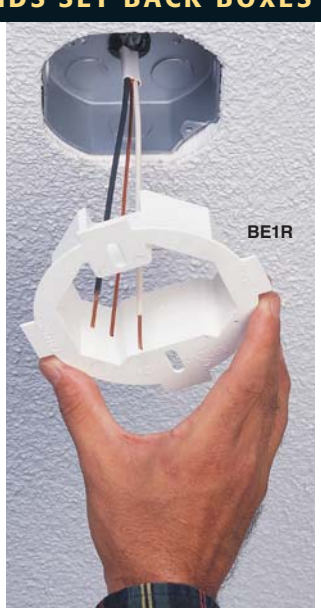
Product Info aifittings.com/landing/recessed-tv-boxes

UL LISTED • 2-HOUR FIRE RATING

Made in USA

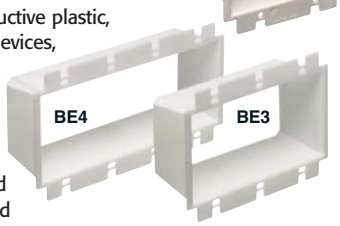
LISTED BOX EXTENDERS

EXTENDS SET BACK BOXES UP TO 1-1/2 INCHES



Arlington's **UL/CSA Listed** Box Extenders extend set back electrical boxes up to 1-1/2".

Made of heavy-duty, non-conductive plastic, they level and support wiring devices, protecting wires against damage and stripping.



BE1R for round or octagonal boxes, the single-gang (BE1), two-gang (BE2) for all standard devices, switches and GFCIs and **three- and four-gang box extenders for multiple gang boxes!**

*Try them all, including our Patented **'Larger Flange' one-, two-, three-** and **four-gang styles**, for the safe, easy way to obtain Listed installations in set back boxes!*

Larger Flanges (patented)

TWO HOUR FIRE RATING

for use with Metallic and Non-Metallic boxes

Arlington® 800/233-4717 • www.aifittings.com

Product Info aifittings.com/landing/box-extenders/

Photo courtesy of Larry Craddock

An 8 AWG copper conductor attached to the conductive pool shell. The other end of the conductor is to be attached to the perimeter surface structural reinforcing steel, copper ring, or copper grid.

Photo courtesy of Chris Faucette

An 8 AWG copper conductor attached to perimeter surface structural reinforcing steel.

If the pool is formed with structural reinforcing steel, the steel is required to be bonded together by steel tie wires or the equivalent. If the structural steel is encapsulated in a nonconductive compound, a copper conductive grid that complies with 680.26(B)(1)(b) must be installed. The Code also reiterates that concrete — whether cast in place, pneumatically applied, sprayed, or block — is all considered conductive. Materials such as vinyl liners and fiberglass composite shells are not considered conductive.

List item (2) addresses the perimeter surface that surrounds the pool, and TIA 23-9 created significant changes to these requirements. First, the perimeter surface now extends 3 ft horizontally from the inside wall of the pool as well as 3 ft above and 2 ft below the maximum water level. This includes surfaces such as concrete, pavers, tile, grass, or dirt. There are four bonding options: structural reinforcing steel, steel structural welded wire reinforcement (sometimes also referred to as "wire roll out" or "steel wire mesh roll"), a copper conductor, or a copper grid. A conductive pool shell bonded to a perimeter surface is required to be attached to the pool reinforcing steel or copper conductor grid at a minimum of four points uniformly spaced around the perimeter of the pool.

In installations where the bonded perimeter surface does not surround the entire pool, the perimeter surface is required to be attached to the pool reinforcing steel or copper conductor grid at a minimum of four points uniformly spaced along the bonded perimeter surface. An example of this would be a rectangular-shaped pool where one of the four sides is constructed with a vanishing edge, thus eliminating a perimeter surface on that one side. When bonding to a perimeter surface is required for a nonconductive pool shell, bonding at four points is not required, but the perimeter bonding is required to be attached to the equipotential bonding conductor — and, if present, to any conductive support structure for the pool.

List item (2) sub-section (a) is now titled "Conductive Paved Portions of Perimeter Surfaces," and the requirements have been revised. Conductive paved portions of the perimeter surface are required to be bonded with either unencapsulated structural reinforcing steel or unencapsulated steel structural welded wire reinforcement. If the perimeter surface is absent of reinforcing steel — or the reinforcing steel is encapsulated in a nonconductive compound — unencapsulated welded wire steel reinforcement or a copper conductor grid is required. Both need to be secured directly under the paving and not more than 6 in. below finished grade.

Unencapsulated steel welded wire reinforcement that is not fully embedded in concrete and the copper grid, whether embedded in concrete or not, is required to be listed specifically for corrosion resistance and mechanical performance as of Jan. 1, 2025. The copper grid option is to be constructed of 8 AWG solid bare copper and comply with Sec. 680.26(B)(1)(b)(3). The steel welded wire reinforcement is to be at least ASTM 6x6-W2.0 x W2.0 or No. 3 rebar constructed in a 12-in. grid. Both the copper grid and welded wire must follow the contour of the perimeter surface extending not less than 3 ft horizontally beyond the inside wall of the pool.

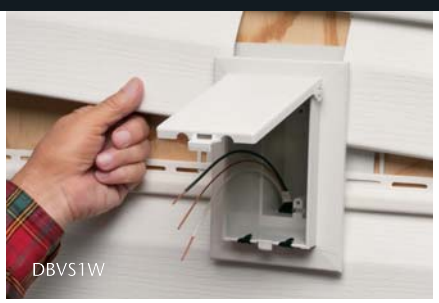
List item (2) sub-section (b), newly titled "Unpaved Portions of Perimeter Surfaces," now also has revised requirements. If a copper conductor is installed, it must have at least one 8 AWG bare solid, including the 8 AWG copper equipotential bonding conductor (if available). The conductor(s) need to follow the contour of the perimeter surface, be located 18 in. to 24 in. from

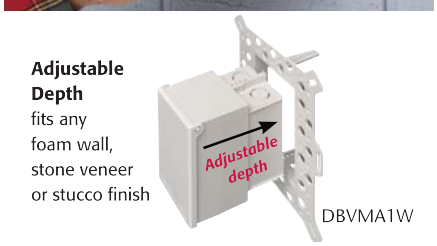
SAVES TIME • LOOKS GREAT!

Made in USA

IN BOX® RECESSED BOX

EXTRA-DUTY, LOW PROFILE COVER





No extra parts to buy or handle mean you save big on labor and materials!

One-piece **IN BOX**®, the recessed, EXTERIOR electrical box, eliminates installing multiple pieces: the box, then the bubble cover assembly, and a mounting block on siding. Plus, the job looks great because IN BOX installs *in the wall.* It's that simple.

Cost savings. Time savings. UL Listing. Great Looks. Get it all in Arlington's one-piece IN BOX!

- Non-metallic, 22.0 cu. inch electrical box with *extra duty* weatherproof-while-in-use white or clear cover
- Single and two-gang, vertical and horizontal, for a variety of new and old work applications
- Accepts single-gang devices - no gaskets required

IN BOX meets 2020 NEC, Section 406.9 *for the protection of exterior outlets which require the use of an extra-duty weatherproof while-in-use cover for all outdoor 15 or 20 AMP receptacles.*

Arlington™

Arlington®

Patented. Other patents pending.

www.aifittings.com Scranton, PA 18517 800/233-4717

Product info aifittings.com/landing/outdoor-inbox/

the inside wall of the pool, be installed under the unpaved portion of the perimeter surface 4 in. to 6 in. below the finished grade, and can only be installed in perimeter surfaces not intended to have direct access to swimmers in the pool. If the copper grid or unencapsulated steel welded wire reinforcement options are installed, they must meet the requirements in Sec. 680.26(B)(2)(a) and be located within the unpaved surface between 4 in. to 6 in. below finished grade.

List item (2) sub-section (c) is now titled "Nonconductive Perimeter Surfaces." Similar to the other sub-sections, it has revised requirements. When nonconductive portions of perimeter surfaces are separated from the earth on nonconducting supports, equipotential bonding is not required. Additionally, when an equipotentially bonded surface supports a perimeter surface that is electrically separated from the pool structure and raised on nonconductive supports, no additional equipotential bonding is required.

List item (2) sub-section (d) is new and titled "Interconnection of Bonded Portions of Perimeter Surfaces." The language added reminds installers that all equipotentially bonded surfaces are to be interconnected using listed splicing devices or exothermic welding. Also, where a copper wire is installed, it is permitted to encircle the pool for bonding connections to noncontiguous perimeter surfaces.

List item (3) addresses bonding any metallic components of the pool structure not previously mentioned. An example is a structural metallic wall panel of an in-ground pool.

List item (4) addresses underwater lighting. Other than listed low-voltage lighting systems with nonmetallic forming shells, all metal forming shells and mounting brackets of no niche luminaires are required to be bonded. For specific information on luminaires, see Sec. 680.23 where wet niche, dry niche, no niche, and through-wall lighting assemblies are described.

List item (5) addresses metal fittings and requires them to be bonded if they are within or attached to the pool structure. There are three exceptions concerning isolated parts and metallic pool cover anchors that are less than certain dimensions. Isolated parts not over 4 in. in any dimension and that do not penetrate the pool structure more than 1 in. meet one exception. Metallic pool cover anchors 2 in. or less in any dimension, and 2 in. or less in length meet the other exceptions.

Photo courtesy of Chris Faucette

Bonding of metal parts of electrical equipment, per list item (6).

List item (6) addresses bonding metal parts of electrical equipment. This includes equipment such as electrically powered pool covers, water circulation, treatment, heating, cooling, or dehumidification, and all electrical equipment installed within 5 ft horizontally from the inside wall of a pool. There is an exception for listed equipment that incorporates an approved system of double insulation.

List item (7) addresses bonding of fixed metal parts installed within 5 ft horizontally from the inside wall of a pool or 12 ft vertically above the maximum water level of a pool, observation stand, tower, platform, or diving structure. This includes fixed metal parts such as door and window frames, fences, awnings, soffits, gutters, and downspouts. An exception exists for a permanent barrier that prevents people from coming into direct contact with the pool.

Section 680.26(C) focuses on the importance of bonding the pool water where none of the bonded parts mentioned above are in direct connection with the pool water. This sometimes happens with a fiberglass or vinyl liner-type pool. In these instances, the pool water is required to be in direct contact with an approved corrosion-resistant conductive surface. This conductive surface must expose at least 9 square inches of surface area to the pool water at all times. It cannot be located where it will be exposed to physical damage or dislodgement during pool activities. Here are a few reminders: Sec. 680.6 requires this conductive surface to be listed, and Sec. 110.3(B) requires listed equipment to be installed and used in accordance with any instructions included in the listing.

FINAL THOUGHTS

On a warm summer day, there is no better way to cool off than by going for a dip in a pool, but safety must always be a top priority. Equipotential bonding helps mitigate potential shock hazards and voltage gradients while also creating a safer pool environment.

Electrical safety around pools is an ongoing process, as can be seen in the many revisions made to Art. 680 this cycle. Everyone plays a part in making pools safer, with public input currently being sought until Sept. 7, 2023 for the next round of potential Art. 680 modifications. These would be slated for the 2026 edition of the NEC. Further information can be found at www.nfpa.org/70. EC&M

Vince Della Croce is a Business Development Manager of Electrical Inspectors for Siemens Smart Infrastructure USA. Licensed in Florida as a master electrician and Washington as an electrical administrator, he holds an Associate of Science degree in Electronic Engineering and Electrical Maintenance Technology from Penn Foster College. Vince is education chairman for the IAEI Southern Section and Florida Chapter, serves on NEC Code Making Panel 17, and is a technical committee member of NFPA 73 Electrical Inspection of Existing Dwellings, NFPA 99 Health Care Facilities, and NFPA 1078 Electrical Inspector Professional Qualifications. He can be reached at vincent.della_croce@siemens.com.

Computers, Software, & Apps

Industrial Panel PC

The new XP504 from the XP500 series industrial panel PC is equipped with a scratch-resistant toughened glass screen, cast-aluminum housing, and a fanless design. The industrial PCs in the XP500 series provide a high-end HMI solution and offer modularity, durability, and intuitive operation. The product range centers around the capacitive multi-touch devices, which offer widescreen displays measuring 10.1 in., 15.6 in., and 21.5 in. These devices enable precise, multi-finger operation of the user interface. The devices run on the Windows 10 operating system in order to make integration into existing production networks and administration as straightforward as possible, according to the company.

Eaton

Business Tools App

The MVPs Business Tools feature is available now via the company's website and mobile app, offering time-saving solutions, maximizing time on the job site, and remote operation. Users can use the feature to simplify their resupply process with easy order placement and tracking. App and website features include online quoting, volume savings program, ability to automatically reorder frequently purchased items, and order tracking. The new suite of tools complements the company's existing MVPs Pro Rewards and Partnership Program, which is designed to reward businesses of all sizes with benefits, such as bonus points earned on select items.

Lowe's

EV Management Solution

The new solar-attached electric vehicle (EV) management solution further expands the company's growing suite of C&I-focused products and software. The product manages and optimizes the EV charging process for sites that require dynamic load management and have large quantities of EVs, such as apartment buildings, workplaces, and public charging locations. Built on advanced AI-based predictive algorithms, the solution incorporates real-time data analytics and considers solar production, dynamic electricity prices, and tiered charging schedules. By integrating with the company's energy management system, this new offering orchestrates and optimizes interactions between facility solar generation, stationary battery storage, and large-scale EV charging.

SolarEdge

Electrical Design Software

Advanced Electrical Design for Autodesk Revit (v24.0.0) offers users intelligent, unified, and connected workflows. The new software enables electrical engineers and designers to play a leading role in designing high-performance buildings for the new energy landscape. The platform integrates directly with Revit, creating a complete BIM solution that connects teams, data, and workflows across the entire electrical and project life cycle in a single tool. The software allows users to plan, analyze, optimize, and document electrical plans in a single place.

Schneider Electric

NEC Requirements for Motors — Part 1 of 2

Do you know the basics of Art. 430, including what overload protection is and what the requirements are for overload protection?

By Mike Holt, NEC Consultant

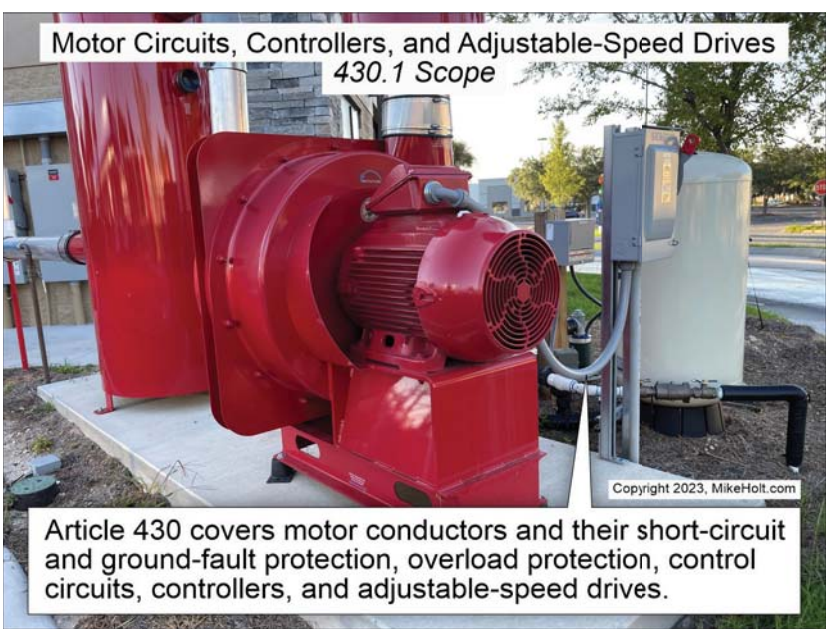


Fig. 1. Use the rules in Art. 430 to calculate and apply overcurrent protection for motors.

Article 430 contains the specific rules for conductor sizing, overcurrent protection, control circuit conductors, controllers,, and disconnects for electric motors. The installation requirements for air-conditioning and refrigeration equipment are in Art. 440; those supplement or amend Art. 430 requirements.

Article 430 is long and complex because motors are complex. They are inductive loads with a high-current demand at start-up (typically six or more times the running current). This makes overcurrent protection for motor applications necessarily different from the overcurrent protection for other types of equipment. So, do not confuse general overcurrent protection with motor protection — you must calculate and apply them differently using the rules in Art. 430 (**Fig. 1**).

TABLE FLC VERSUS MOTOR NAMEPLATE CURRENT RATING

The size of conductors supplying equipment covered by Art. 430 must be selected from the ampacity tables per Sec. 310.15 or be calculated per Sec. 310.14(B) [Sec. 430.6].

Determine motor current ratings using:

- Section 430.6(A)(1) Table Full-Load Current (FLC). Use the motor full-load current ratings in Tables 430.247 through 430.250 to determine conductor sizing [Sec. 430.22] and the branch-circuit short-circuit and ground-fault overcurrent protection size [Sec. 430.52 and 430.62].
- Section 430.6(A)(2) Motor Nameplate Current Rating (FLA). Overload devices and conductor sizing for other than continuous-duty motors must be sized based on the motor nameplate full-load ampere (FLA) rating per Sec. 430.31.

MOTOR LOCATIONS

Locate motors so they have adequate ventilation and can readily be maintained [Sec. 430.14(A)]. Locate open motors with commutators or collection rings so they don't spew sparks onto combustible material [Sec. 430.14(B)].

HIGHEST RATED MOTOR

You determine the highest rated motor of a group when you need to calculate conductor size and the short-circuit ground-fault protective device/the conductors are supplying more than one motor [Sec. 430.24]. The highest rated motor of the group is the one with the largest full-load current (FLC) rating as listed in Tables 430.247 through 430.250 [Sec. 430.17].

MOTOR CONDUCTOR SIZE

Branch-circuit conductors to a single motor in a continuous-duty application must have an ampacity of at least 125% of the motor's FLC as listed in Tables 430.247 through 250 [Sec. 430.6(A)(1) and Sec. 430.22(A) through (G)], as shown in **Fig 2** on page 66.

Mike Holt's ULTIMATE TRAINING LIBRARY

Ideal for In-house Training, Code Review, Exam Preparation and more...

Invest in yourself...

This library includes:

- Code Training
- Electrical Exam Preparation
- Electrical Fundamentals
- Solar Photovoltaic Systems
- Business and Estimating

The Ultimate Training Library is your complete toolbox for electrical education. It's a great solution for teaching new employees the Code, or for preparing for a state or county electrical exam. Ideal for updating yourself and your team on the Code changes, or reviewing the fundamentals that every working electrical professional should know. This library will give you the edge for your business and your career.

2023 NEC® EDITION AVAILABLE

"...as for me and my house, we will serve the Lord." [Joshua 24:15]

SAVE **25% OFF**
Limited Time Offer

ORDER TODAY
MikeHolt.com/Ultimate
Use Discount Code: ECMULT

Special expires in 30 days and can't be combined with any other offer

SCAN NOW TO LEARN MORE

Mike Holt Enterprises
MikeHolt.com • 888.632.2633

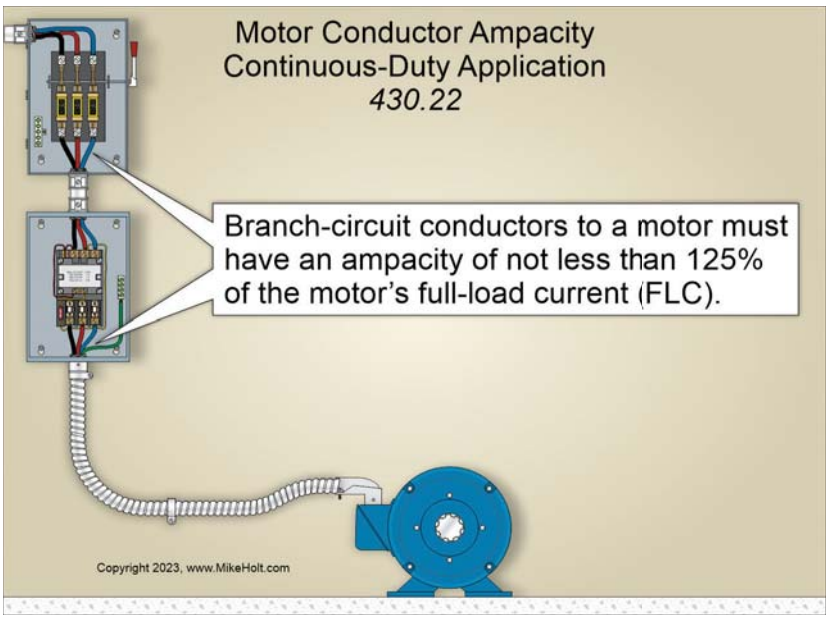


Fig. 2. Branch-circuit conductors to a single motor in a continuous-duty application must have an ampacity of at least 125% of the motor's full-load current (FLC).

Conductors that supply several motors must be sized to at least the sum of the four quantities enumerated in Sec. 430.24 (1) through (4). These are:

(1) 125% of the highest rated motor's FLC as listed in Tables 430.247 through 250.

(2) The sum of the FLC of the other motors as listed in Tables 430.247 through 250.

(3) 100% of the noncontinuous non-motor load.

(4) 125% of the continuous non-motor load.

The last sentence above each table allows us to use the ampacity columns for a range of system voltages without any adjustment. The conductor size must be selected from Table 310.16 per the terminal temperature rating (60°C or 75°C) of the equipment [Sec. 110.14(C)(1)]. Don't use the motor nameplate FLA [Sec. 430.6(A)(2)] to determine the motor conductor size.

Motor applications are considered continuous duty unless the nature of the control or apparatus the motor drives is designed so the motor will not operate continuously under load [Table 430.22(E) Note]. When a motor is not continuous duty because of this type of application, size the conductors using the percentages of Table 430.22(E). If a motor must stop when performing its function (such as in the case of an elevator motor), it is a good sign the motor is intermittent duty.

Conductors for a motor used in a short-time, intermittent, periodic, or varying-duty application must have an ampacity of at least the percentage of the motor nameplate FLA rating shown in Table 430.22(E).

OVERLOAD

An overload is a condition where equipment operates above its current rating,or where the current exceeds the conductor ampacity. When an overload condition persists, equipment failure or fire from damaging or dangerous overheating can result. A fault, such as a short circuit or ground fault, is not an overload [Art. 100].

Overload devices protect motors, motor control equipment, and motor branch-circuit conductors against excessive heating due to motor overloads and failure to start — but not against short circuits or ground faults. Overload protection is not required where it might introduce additional or increased hazards, as in the case of fire pumps [Sec. 430.31(A)].

Overload devices can be:

- Thermal overloads (heaters) in an overload relay of a motor contactor (starter). These heater units are

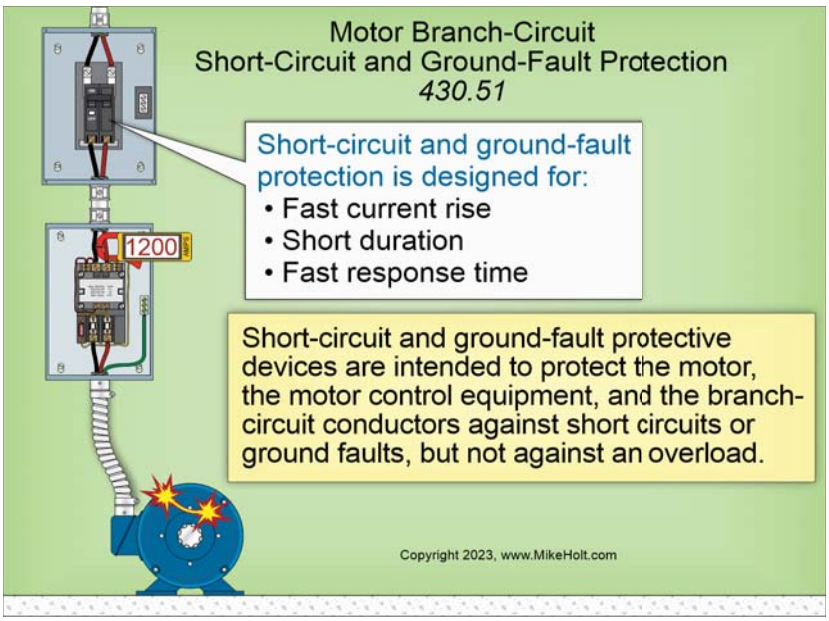


Fig. 3. Section 430.51 specifies devices intended to protect overcurrent due to short circuits or ground faults.

selected using a chart or size given by the manufacturer.

• Solid-state (electronic) overloads have an adjustment dial for setting the trip level. They are installed in an overload relay of a motor contactor (starter).

• Inverse time circuit breakers and dual element fuses can serve as both motor overload protection and the motor short-circuit ground-fault protection if the requirements of Sec. 430.32 are met [Sec. 430.55].

• Fuses, when sized per Sec. 430.32(A) [Sec. 430.36].

OVERLOAD SIZING FOR CONTINUOUS-DUTY MOTORS

Motors rated more than 1 hp (used in a continuous-duty application without integral thermal protection) must have the overload device(s) sized per one of the four methods required in Sec. 430.32(A)(1) through (4).

For example, you can use a separate overload device. This device must be selected to open at no more than 125% of the motor nameplate FLA rating depending on service factor or temperature rise:

• *Service Factor (SF).* Motors with a marked service factor of 1.15 or more on the nameplate must have the overload device sized at not more than 125% of the motor nameplate current rating. Motor service factors are safety factors; they indicate how much the motor capacity can be exceeded for short periods without overheating. For example, a motor with a service factor of 1.15 can operate at 15% more than its rated output without overheating. This is important for motors where loads vary and may peak slightly above the rated torque.

• *Temperature Rise.* Motors with a nameplate temperature rise of 40°C or less must have the overload device sized no more than 125% of the motor nameplate current rating. A motor with a nameplate temperature rise of 40°C means the motor is designed to operate so it will not heat up more than 40°C above its rated ambient temperature when operated at its rated load and voltage. Studies have shown that when the operating temperature of a motor is increased 10°C above its rating, the motor winding insulating material's anticipated life is reduced by 50%.

EXAMPLE

Question: A motor has a nameplate that specifies a service factor of 1.12 with a temperature rise of 41°C and a nameplate full load current rating of 25A. What size dual-element time-delay fuse is required for the overload protection of this motor?

Solution: Since the service factor of 1.12 is less than 1.15, and 41°C is over 40°C, the overload protection is sized based on 115% of the motor nameplate ampere rating [Sec. 430.6(A)(2)].

Overload Protection = 25A × 115%

Overload Protection = 28.75A

Answer: Therefore, use a 25A dual-element time-delay fuse [Sec. 240.6(A)].

Other Motors. No more than 115% of the motor "nameplate current rating."

BRANCH-CIRCUIT SHORT-CIRCUIT AND GROUND-FAULT PROTECTION

A branch-circuit short-circuit and ground-fault protective device (OCPD) protects the motor, the motor control equipment, and the conductors against short circuits or ground faults, but not against overload [Sec. 430.51] (**Fig. 3**).

We'll get into the details in Part 2 of this article.

FUNDAMENTALLY DIFFERENT

It should be clear at this point that conductor protection for motors is fundamentally different from conductor protection in other applications. Why is this?

When voltage is first applied to the field winding of an induction motor, only the conductor resistance opposes the flow of current through the motor winding. Because the conductor resistance is so low (practically a dead short), the motor will momentarily have a large inrush current.

Once the rotor reaches its rated speed, the starting current reduces to running current due to counter-electromotive force (CEMF).

If the rotating part of the motor winding (armature) becomes jammed so it cannot rotate, no CEMF will be produced in the motor winding. This results in a decrease in conductor impedance to the point that it is effectively a short circuit. The motor then operates at locked-rotor current (often six times the full-load ampere rating), depending on the motor's Code letter rating [Sec. 430.7(B)]. This condition will cause the motor winding to overheat and be destroyed if the current is not quickly reduced or removed. EC&M

These materials are provided by Mike Holt Enterprises in Leesburg, Fla. To view Code training materials offered by this company, visit www.mikeholt.com/code.

Stumped by the Code?

By Mike Holt, NEC Consultant

All questions and answers are based on the 2023 NEC.

Q. What are the conditions TC cable can be used and installed?

A. Section 336.10 lists the conditions that TC cable can be used and installed.

Type TC cable is permitted to be used:

(1) For power, lighting, control, and signaling circuits.

(2) In cable trays including those with mechanically discontinuous segments up to 1 ft.

(3) In raceways.

(4) In outdoor locations supported by a messenger wire.

(5) For Class 1 circuits in accordance with Art. 725.

(7) Between a cable tray and equipment if it complies with Sec. 336(10)(7).

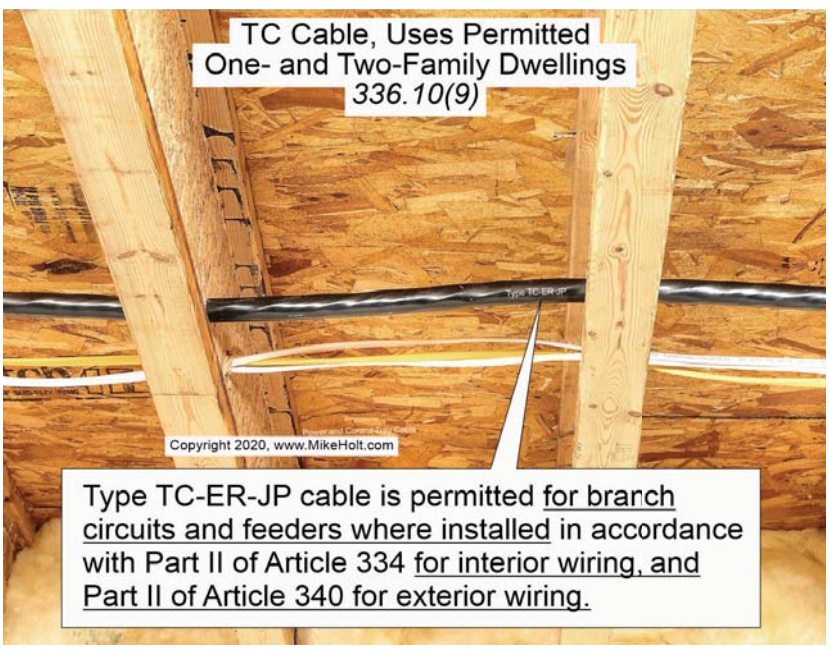
(8) In wet locations where the cable is resistant to moisture and corrosive agents.

(9) In one- and two-family dwellings, Type TC-ER-JP cable is permitted for branch circuits and feeders where installed in accordance with Part II of Art. 334 for interior wiring, and Part II of Art. 340 for exterior wiring (see **Figure**).

Exception: Where Type TC cable is used to connect a generator and its associated equipment, the cable ampacity limitations of Sec. 334.80 and Sec. 340.80 do not apply.

Author's Comment: The "ER" marking on Type TC-ER cable identifies it as suitable for exposed run use in accordance with UL. The "JP" marking on Type TC-ER-JP cable identifies it as suitable to be pulled through wood framing members because the cable has met the joist pull testing requirements of UL.

(10) Direct buried where identified for direct burial.



Q. Under what conditions can TC cable not be used and installed?

A. The conditions where TC cable cannot be used and installed are stated in Sec. 336.12.

Type TC cables are not permitted:

(1) Where exposed to physical damage.

(2) Outside a raceway or cable tray system, except as permitted in Sec. 336.10(4), Sec. 336.10(7), Sec. 336.10(9), and Sec. 336.10(10).

(3) Exposed to the direct rays of the sun, unless identified as sunlight resistant.

Q. How much can you bend TC cable?

A. According to Sec. 336.24, bends in Type TC cable must be made so the cable will not be damaged. Type TC cable without metal shielding must have a minimum bending radius as follows:

(1) Four times the overall diameter for cables 1 in. or less in diameter.

According to Sec. 336.24, bends in Type TC cable must be made so the cable will not be damaged.

(2) Five times the overall diameter for cables larger than 1 in. but not more than 2 in. in diameter. EC&M

These materials are provided by Mike Holt Enterprises in Leesburg, Fla. To view Code training materials offered by this company, visit www.mikeholt.com/code.

Illustrated Catastrophes

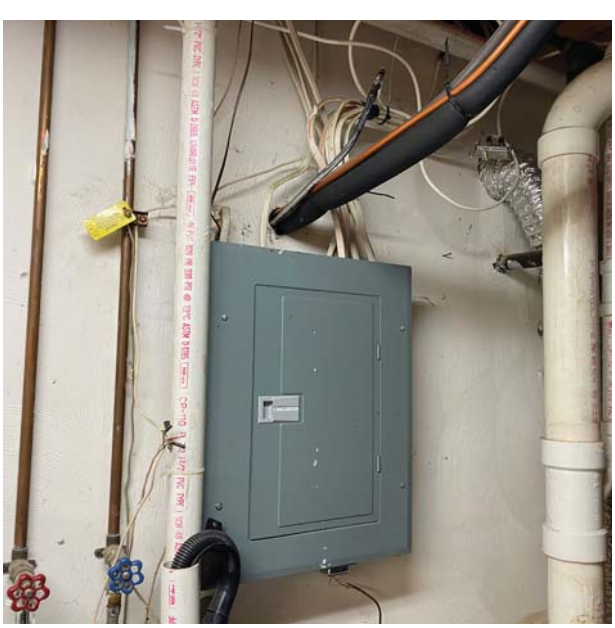
By Russ LeBlanc, NEC Consultant

All references are based on the 2023 edition of the NEC.

CABLE CLUSTER

While this installation appears to have been installed prior to the existence of the 2023 Code, it still provides us with an opportunity to show some examples of Code violations based on the newest edition of the Code. New Art. 722 provides requirements for cables installed for Class 2 and Class 3 power-limited circuits and Class 4 fault-managed power circuits. Section 722.24(B) informs us that these cables cannot be strapped or attached by any means to the exterior of any raceway, including the surface metal raceway shown in this photo. Neither of the exceptions for this rule is applicable to this installation. For communication circuits, Sec. 800.133(C) also prohibits cables from being attached by any means to the exterior of any raceway as a means of support. The exception for this rule is not applicable here. Securing the power supply cord to the exterior of the raceway is also a violation. Section 300.11(C)(1) allows cables, raceways, or other nonelectrical equipment to be supported by raceways, but only where the raceway or means of support is identified as a means of support. A surface metal raceway is not identified for this purpose.

A NOT-SO-COOL INSTALLATION



I'm assuming that this panelboard was installed before the HVAC installer ran the refrigerant lines for his air conditioning equipment. He should have found a better place to run those lines because he created a violation of the dedicated space requirements in Sec. 110.26(E)(1)(a) by installing them directly above the panelboard enclosure. The space directly above this panelboard (extending to 6 ft above the panelboard or to the structural ceiling if lower) is reserved for the electrical installation. No piping, leak protection equipment, ducts, or other equipment foreign to the electrical installation is permitted to be located in this zone. This dedicated space also extends down to the floor level. The electrician who installed the NM cables entering the top of this enclosure also made some mistakes. The NM cables are not properly supported and secured within 12 in. of the cabinet, as required by Sec. 334.30. There are also several low-voltage cables strewn about this area, and they are not installed as professionally and skillfully as they should have been as required by newly revised Sec. 110.12. In a bit of a twist, when installing Class 2 and Class 3 cables, Sec. 722.24(A) still uses the language "neat and workmanlike," which was removed from Sec. 110.12 for 2023.

August Issue Preview

THEME: OPERATIONS AND MAINTENANCE

FEATURES/SPECIAL REPORTS

Test & Measurement Best Practices

Product of the Year Winners

NEW PRODUCT SHOWCASE:

Personal Protective Equipment

Issue Close: 7/20/2023 • Materials Due: 7/28/2023

www.ecmweb.com

ADVERTISER INDEX

Advertiser	Page #	Phone #	Web Address
Arlington Industries, Inc.	27	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	29	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	31	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	33	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	35	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	37	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	39	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	41	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	43	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	45	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	47	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	49	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	51	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	53	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	55	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	57	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	59	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	61	800-233-4717	www.aifittings.com
Arlington Industries, Inc.	72	800-233-4717	www.aifittings.com
Atkore	IFC	—	www.alliedeg.us
Atkore FRE Composites	21	—	www.atkore.com/fre
AutomationDirect	1	800-633-0405	automationdirect.com/t-slotted-rails
Cerrowire	15	800-523-3869	www.cerrowire.com
Champion Fiberglass, Inc.	BC	—	www.championfiberglass.com
ICC Premise Wiring	7	—	www.icc.com/distributor
Intermatic, Inc.	23	—	www.Intermatic.com/ARISTA
Mike Holt Enterprises	65	888-632-2633	www.mikeholt.com
Orbit Industries, Inc.	17	844-909-0457	www.orbitelectric.com
Phoenix Contact	9	—	phoenixcontact.com/us-TOOLfox
Power Probe Group, Inc.	13	833-533-5899	www.kps-usa.com
Progressive Insurance	11	—	www.ProgressiveCommercial.com
Socomec, Inc.	IBC	—	www.socomec.us
S-P Products, Inc.	5	800-233-8595	www.SPProducts.com
Uline	18	800-295-5510	www.uline.com
Underground Devices, Inc.	3	847-205-9000	www.udevices.com
Vehicle Fleet Buyers	19	619-213-1025	fleetbuyers77@hotmail.com

(Every effort is made to ensure the accuracy of this index. However, the publisher cannot be held responsible for errors or omissions.)

SALES STAFF

To place a display ad (1/6 page or larger), call the Advertising Sales Representative for your area.

Vice President
Mike Hellmann
Andover, MA
Phone: (978) 289-0098
E-mail: mhellmann@endeavorb2b.com

Western U.S. & Western Canada
Ellyn Fishman
Key Account Manager
(949) 239-6030
Email: efishman@endeavorb2b.com

Northeast U.S. & Eastern Canada
David Sevin
Account Manager
24 Houghton Street
Barrington, RI 02806
Phone: (401) 246-1903
E-mail: dsevin@endeavorb2b.com

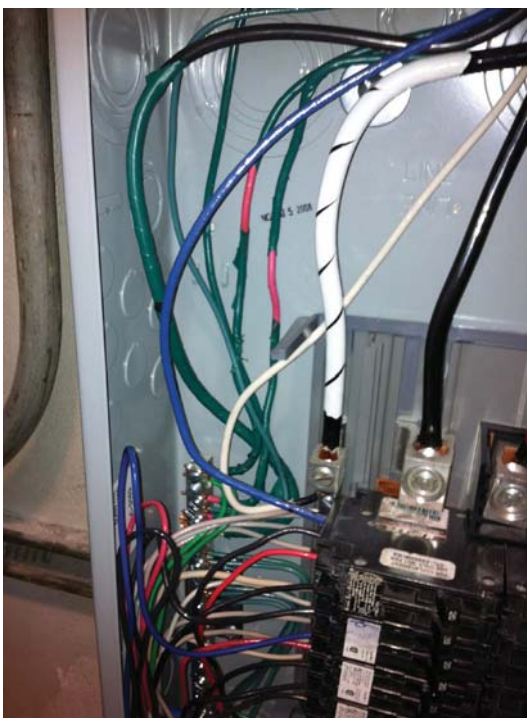
Midwest, Southeast, and Southwest
Jay Thompson
Account Manager
10955 Lowell Ave., 7th Floor
Overland Park, KS 66210
Phone: (913) 967-7543
E-mail: jthompson@endeavorb2b.com

Classifieds/Inside Sales
Steve Suarez
Media Account Exec
10955 Lowell Ave., 7th Floor
Overland Park, KS 66210
Phone: (816) 588-7372
E-mail: ssuarez@endeavorb2b.com

List Rental
Smart Reach
E-mail: sr-assets@endeavorb2b.com

What's Wrong Here?

By Russ LeBlanc, NEC Consultant



How well do you know the Code? Think you can spot violations the original installer either ignored or couldn't identify? Here's your chance to moonlight as an electrical inspector and second-guess someone else's work from the safety of your living room or office. Can you identify the specific Code violation(s) in this photo? *Note*: Submitted comments must include specific references from the 2023 NEC.

Hint: Wrongly reidentified reds

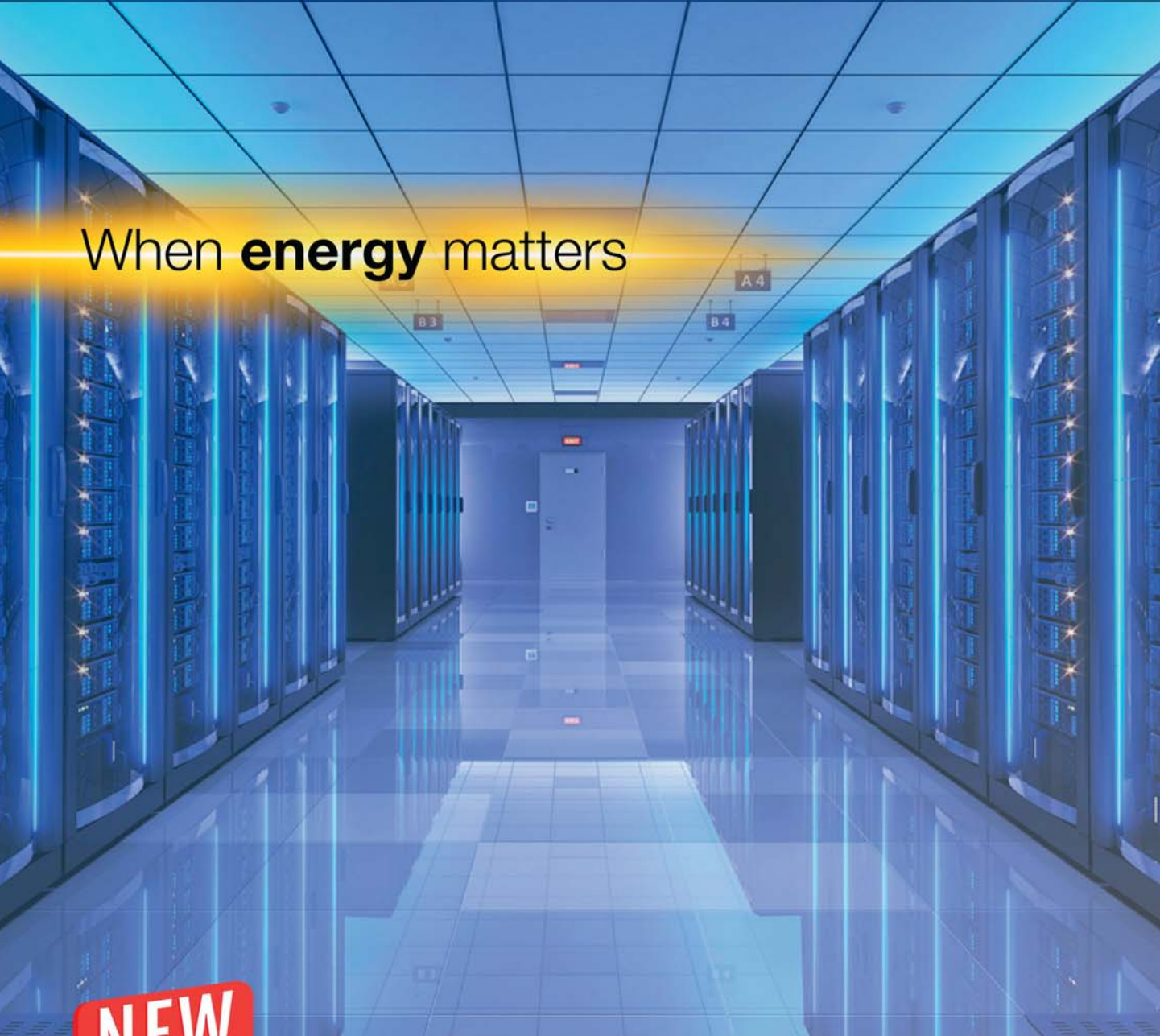
'TELL THEM WHAT THEY'VE WON...'

Using the 2023 NEC, correctly identify the Code violation(s) in this month's photo — in 200 words or less — and you could win an Arlington Industries 18-in. Slider Bar and plastic box for mounting between studs with non-standard spacing. E-mail your response, including your name and mailing address, to russ@russleblanc.net, and Russ will select three winners (excluding manufacturers and prior winners) at random from the correct submissions. Note that submissions without an address will not be eligible to win.

MAY WINNERS

Our winners this month were Roger Ervine, an *EC&M* reader from Windom, Minn., and Walter Jukes, a senior project manager for Creative Engineering Group of Canoga Park, Calif. They knew that having a panelboard full of circuit breakers in a janitor's closet violated several Code rules.

Section 240.24(A) requires circuit breakers to be readily accessible. Climbing over or removing obstacles in order to reach these circuit breakers means they do not meet the Art. 100 definition of readily accessible. Section 240.24(D) prohibits circuit breakers from being in the vicinity of easily ignitable material. This closet has mops, cleaning supplies, and paper towels stored in it. All of these items could provide fuel for a fire. Section 110.26(B) prohibits items from being stored in the working space required for this electrical equipment. Lastly, there are two red fire alarm cables running next to the drainpipe on the right side of the closet that do not comply with the installation requirements of Sec. 760.24(A). Exposed fire alarm cables must be installed so they won't be damaged during normal building use.



NEW

DIRIS Digiware BCM

Socomec DIRIS Digiware BCM

Branch-Circuit Meter Strip With Integrated Current Sensors

The DIRIS Digiware BCM is a branch-circuit meter strip with 21 integrated sensors and allows individual circuit monitoring within any electrical panelboard (Remote Power Panel, lighting panel, power panel, etc.).

The DIRIS Digiware BCM is equipped with three RJ12 channels which can connect to TE/TR/TF current sensors to monitor the main feed or an extra circuit.

.5% Global Accuracy | Fast & Easy to Install | Minimal Footprint | Robust Design

Discover our DIRIS Digiware SBCM brochure to build your own system today!

socomec
Innovative Power Solutions

CHAMPION FIBERGLASS®

TOUGH. STRONG. PROTECTIVE.

PERFORMANCE ELBOWS FOR DATA CENTERS.

Fiberglass conduit is a lightweight, durable alternative to GRC in data centers.

- No burn-through eliminates elbow repairs
- Lower coefficient of friction for smooth pulls
- Fault resistance makes repairing cables easy
- Durable and corrosion-resistant for project longevity
- Available with lower material and installation cost

DOWNLOAD THE ELBOW COMPARISON

MADE IN THE USA

MasterSpec® a product of The American Institute of Architects

BIM models available at championfiberglass.com/BIM