The TJCAA Quarterly

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Message from the President

We've moved!

TJCAA's Business Certifications

- Alameda County Small, Local Emerging Business
- Bay Area Green Business Program
- California DGS SBE
- City of Colton SBE
- City of Los Angeles SBE
- City of Oakland LBE
- Eastern Municipal Water District SBE
- Inland Empire Utilities Agency SBE
- Metropolitan Water District of Southern California SBE
- Sacramento Municipal Utilities District (SMUD) SEED Vendor
- San Diego County Water Authority SBE
- Port of Long Beach SBE
- Port of Oakland LIABE/SBE/VSBE
- PWC Registration—Dept of Industrial Relations (DIR)
- West Basin Municipal Water District SBE

Message from the President, Gianna Zappettini

What a year! Generally, this is a time when we reflect on the good things that happened. But finding the silver lining with the effects of the global pandemic has made that reflection a bit more difficult. Fortunately, some simple things have been a part of my reflection.

Watching every leaf fall while working remotely

Frequenting local businesses, albeit infrequently

Hiking the neighborhood

A simple thing TJCAA has continued in 2020 is to work closely with our clients and partners to provide excellent engineering services. We intend to do so when the new year arrives, too. TJCAA sends its best wishes for a safe and healthy 2020 holiday season, and we look forward to working with you in 2021.

We've moved!

Our Oakland office has moved! Here's our new address:

TJC and Associates, Inc.
1111 Broadway, Suite 300
Oakland, CA 94607

Our phone number is staying the same: (510) 251-8980.

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What is bench testing?

Did you know—
What is bench testing?

Our instrumentation and controls engineers perform bench testing to evaluate our control systems programming and new electronic equipment before installing it at our clients' facilities, to ensure that it is in perfect condition and is performing as expected. The phrase "bench testing" has its roots in the process of critically evaluating something at an actual lab bench, where an engineer or technician works with a piece of equipment, testing its performance and construction with a variety of tools.

TJCAA Electrical Engineer Lee Meyer has performed bench testing of programs and hardware deployed for many of our clients' SCADA (supervisory control and data acquisition) systems. He explains that the bench tests involve a methodical, point-to-point process in which he tests every control algorithm that has been programmed, as well as every signal, to be sure that it is transmitted correctly.

Pictured here is his set-up for a recent run of bench tests, performed at his home office. On this occasion, he was testing local operator panels (pictured at right in the photo). The LOPs are small displays that will be mounted on a control panel door to interface with a programmable logic controller inside the enclosure.

There are a couple of ways to perform bench testing for these, Lee notes. One is to have all of the hardware present at the bench test (the LOPs and the PLCs, for example) and test every signal between them. Another method, which he was using here, is to simulate the PLC using software, and go through every procedure that way. "We just have to make sure that everything is doing what it is supposed to," he says. He was using Schneider software for this particular PLC simulation.

"Almost every time we find something that needs to be corrected," Lee tells us. For example, during one bench test, he found that an LOP was looking for a one-based PLC, but the PLC was a zero-based system. "The LOP lit up, but didn't work as intended." Fortunately, the bench testing process identified and corrected the mismatch before the equipment was put into action at a critical public facility.

When we are able to, and the client wishes to, we perform "witness bench testing," in which our clients observe the bench testing process. Through this process our clients are able to walk through each step of the program logic with us, providing an intimate understanding of the program that will be installed.

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What is bench testing?

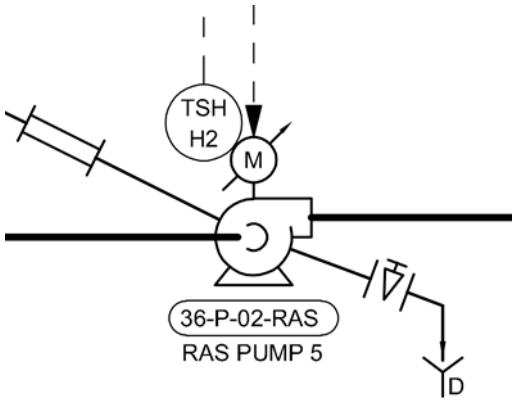
What's that on my drawing?

Bench testing is only part of the careful commissioning process we use before "flipping the on switch." After bench testing off-site and installation at the client site, we do operational readiness testing, which involves another full point-to-point test using the installed hardware and wiring to make sure that the equipment is ready to run. After that, we perform functional acceptance testing, in which we run through all of the control strategies during actual facility operation and make sure the equipment is all functioning as expected.

If you have questions about bench testing your new or modified equipment, please contact us.

What's that on my drawing?

Our engineers prepare numerous drawings during the course of design. These drawings depict a wide variety of information about a project, including structural, electrical, instrumentation, and controls schematics, plans, and details. We thought it would be useful and fun to provide a crash course and over time, a few "mini quizzes" on reading some of these engineering drawings.



Most of our readers will be familiar with floor plans and site plans, given that we run into these in many life situations, as well as in our jobs. Fewer of us, on the other hand, have frequent opportunities to peruse P&IDs (piping and instrumentation diagrams). TJCAA's designs often include P&IDs, which are schematic representations of pipes, conduit, equipment, controls, and instrumentation in a facility such as a treatment plant or pump station.

P&IDs are one of the main deliverables of engineering done at the front end of an instrumentation, control, and electrical (ICE) design. The P&IDs are drawn in close collaboration with the project mechanical/process engineer. The process engineer prepares a process flow diagram that schematically depicts the flow of fluids through the facility. This process flow diagram shows the pipes sizes and the configuration of equipment (such as pumps, valves, and flow meters) in the system. Our ICE engineers complete the P&ID by adding information about electrical connections from the piping system to the controls.

Designers, control system programmers, contractors, and operators use the P&IDs in many ways. They can help when designing the physical ICE layout of a facility, to be sure, but also can provide important information for many other aspects of a project:

- cost estimating
- planning for construction phasing
- programming control systems

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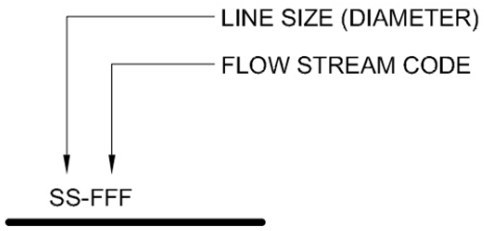
What's that on my drawing?

In addition, the P&IDs can provide a common frame of reference when discussing operations. A wealth of information is shown on a P&ID, such as the parameter measured and type for every instrument, all valves and their IDs, control inputs and outputs, and all mechanical equipment with descriptions and tags. We draw our P&IDs according to American National Standards Institute/International Society of Automation standards.

A good starting point for learning to read P&IDs is the lines. Lines on a P&ID consist of piping and instrument line symbols. Solid lines show piping that carries a flow stream. In a water or wastewater treatment plant, for example, some of the flow streams would be wastewater, sludge, or scum. In other facilities, streams could include water, air, or ammonia.



Bold lines show the primary process, and normal weight lines show the secondary process. The lines are labeled with the pipe diameter and a flow stream code. The example here depicts a 14-inch pipe that carries return activated sludge.

Solid lines also show instrument sensing lines and connections to process. One of these lines would appear, for example, between a flow meter and the pipe for which the flow is measured.

Dashed lines show electrical connections between process and remote monitoring locations that could be remote indicators or plant SCADA.

As an example, one of the dashed lines above could be used to show that a flowmeter is connected to a plant SCADA system.

P&IDs also use numerous symbols and codes to show other features of the process, including equipment, valves, and instrumentation. We will cover some frequently used symbols in our next edition, but in the meantime, here's a little quiz for you.

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What's that on my drawing?

Emergency Power Considerations

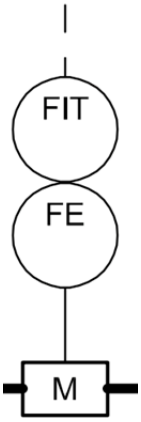
QUIZ - This P&ID symbol shows which of the following?

a) Motor with fuel sources

b) Main shutoff valve for a process flow line, connected to plant SCADA

c) Magnetic flow meter for a process flow line, with mechanical readout, connected to an external readout (indicator or plant SCADA)

d) Masked man selling festive balloons



Answer on page 7.

Emergency Power Considerations

TJCAA's clients in the public sector require reliable power supplies to provide their services, and the potential for power loss to some facilities can be a critical public health and safety concern. Interruptions to utility power can occur in many ways. Earthquakes and storms can cause damage resulting in outages. A temporary shutoff may occur for planned maintenance. Acts of terrorism could cause an outage, as could damage caused by wildlife. In addition, Public Safety Power Shutoff events conducted by Pacific Gas & Electric Company, Southern California Edison, and San Diego Gas & Electric have highlighted the need for reliable backup power sources.

In the event of a power outage, public facilities will require a separate means of power other than the utility to stay operational. TJCAA provides ICE and structural engineering services for standby and emergency power sources including planning, evaluation, design, alternate delivery methods, and engineering services during construction. We recently evaluated standby power alternatives for Pasadena Water and Power, for its Ross Booster Pump Station, which fills a reservoir to provide water in the area.

We looked at installing a permanent, stationary standby generator on-site and compared it to installing a generator connection and using one of PWP's fleet of portable trailer-mounted generators that would be brought to the site during an outage. Either of the units would require compliance with applicable regulations from the Environmental Protection Agency, California Air Resources Board, and the regional Air District that provides air quality constraints and is responsible for permitting.

For this project and others that involve standby power sources, factors to consider are siting, fuel source, fuel storage, power connection requirements, emissions, noise, cost, performance, and ease of integration.

Permanent Standby Generators

A permanent on-site generator, when coupled with an automatic transfer switch, provides backup power that eliminates the need for manual intervention during the outage and minimizes station downtime. For sites that are critical to system operation, a permanent standby generator with automatic transfer switch is preferred.

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Emergency Power Considerations

Permanent standby generators are also available with superior emissions and noise control options when compared to portable generators, making them a better option at locations near sensitive receptors if extended standby run times are anticipated (i.e., at locations where utility service has a history of unreliability or high probability of Public Safety Power Shutoff outages).

Portable Standby Generators

Portable standby generators provide the flexibility of locating generators at various sites as needed, which can increase reliability with a short power restoration time if a generator fails. Mobile gensets can also be more cost effective than permanent installations, as they can be applied to multiple sites instead of being limited to a single site. The physical constraints of fitting a mobile genset to a trailer-mounted package, with Department of Transportation road weight and fuel transport limitations can, however, lead to inferior sound attenuation, emissions control, runtime duration, and weatherproofing when compared to a stationary genset.

The table below presents a summary comparison. For PWP's Ross Booster pump station, we recommended a portable standby generator, because the station's associated reservoir can generally be expected to provide adequate supply during a power outage until PWP can mobilize delivery and connection of a portable unit from its existing fleet. The primary feature of a stationary unit, reduced outage time, would provide limited benefits to PWP and did not warrant the additional cost. Contact us if you would like to discuss your standby power needs.

Alternative	Pros	Cons
Permanent Stationary Generator	• Higher uptime of facility due to quick power transfer • No on-site intervention required during a power outage, effectively eliminating delay to restore power and facility function • Superior sound attenuation	• High initial costs • Large footprint at site • Immobile: can only service one site. • Higher air quality constraints • Requires on-site maintenance
Portable Generator	• Single generator can serve multiple sites • Reduced time to repair/replace due to portability and replaceability • Permanent space not required at site to house the generator • Maintenance can be performed at suitable owner facilities • Reduced air quality impacts	• Requires manual transport, connection, starting, and transfer in the event of a power outage, extending delay before power and facility function are restored • During an area-wide or large-scale outage, a unit may not be available if it is being used elsewhere • Inferior sound attenuation, emissions control, tank runtime, and weatherproofing • Additional site security may be necessary to protect unit from theft or vandalism • Limited to diesel-driven equipment

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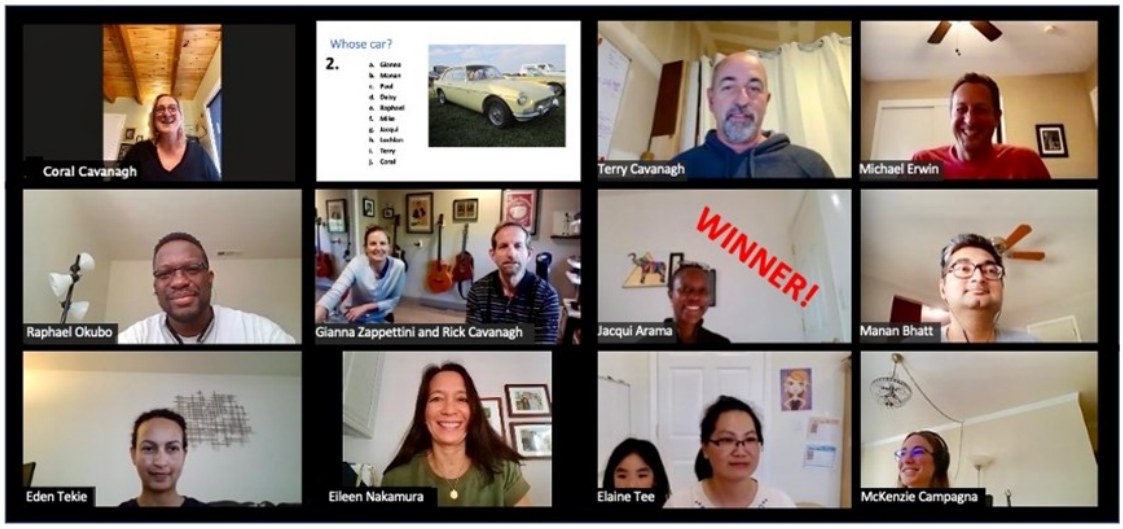
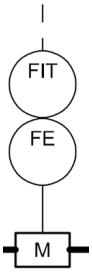
TJCAA Trivia

Do you know which festival in Japan, Korea, and the United States celebrates the spectacular, ephemeral blooming of plants in the genus *Prunus*? That would be the Cherry Blossom Festival, and that was one of the answers during our most recent TJCAA trivia contest (in a "Festival" themed set). Twice this fall, our staff joined together via Zoom for a friendly—and highly competitive—trivia competition. Each contest featured four rounds of text, visual, and audio-based questions and challenged the participants with a wide variety of topics. One personalized, diabolical set required the participants to match TJCAA team member names to photos of their first cars. Big congratulations to TJCAA Electrical Engineer Jacqui Arama, who was victorious in *both contests!*



P&ID Symbol Quiz Answer

This P&ID symbol shows **a magnetic flow meter for a process flow line, with mechanical readout, connected to an external readout (indicator or plant SCADA)**.



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Dates to Note (Subject to change—dates shown are as of publication day)

Dec 21	The Winter Solstice
Dec 21	The Great Conjunction of Jupiter and Saturn
Jan 1	107th Rose Bowl Game
Jan 8	Earth's Rotation Day
Jan 10	Cut Your Energy Costs Day
Jan 16	TJCAA 23rd Anniversary
Jan 20	Inauguration Day
Jan 21	ASCE/SEI 48 Design of Steel Transmission Pole Structures (Virtual Session)
Feb 2	Groundhog Day
Feb 7	Super Bowl LV, Tampa, FL
Feb 12	Chinese New Year (Year of the Ox)
Feb 14	The 63rd Daytona 500
Mar 4	March Forth and Do Something Day
Mar 5	Employee Appreciation Day
Mar 14	Daylight Saving Time
Mar 14	NCAA Basketball Tournament Selection Sunday
Mar 14	Pi Day

Employment Opportunities

TJCAA is looking for qualified engineers to work on great projects with great people. To view and apply for open career positions, visit our website at www.tjcaa.com.