

Scott Fowler

Hello everyone and welcome to the Case for Safety Podcast. I'm your host, Scott Fowler. Appreciate you being with us today for a conversation about electrical safety standards. We're going to be exploring a couple of National Fire Protection Association or NFPA standards, how they complement each other, and what you need to know about them to help keep your team safe. And here to share in their insights on that, I'm very happy to welcome Wes Maertz and Jordan Schlittler of Granger.

Wes is a field safety professional and Jordan is a corporate safety consultant. Wes Jordan, thank you both so much for being here.

Wes Maertz

Happy to be here. Thanks for having us.

Jordan Schlittler

Hey Scott, thanks for having us.

Scott Fowler

Appreciate you taking the time, excited to dive into this topic. And as I mentioned, we're gonna be talking about a couple of NFPA standards, that being 70B and 70E, since they kinda sound alike, wanted to get that out there as we get started. And Jordan, to kick us off, I wonder you could kinda explain how seventy E and seventy B, you know, complement each other and why should organizations view these standards as, you know, partners rather than separate compliance.

Jordan Schlittler

Yeah, sure, it's a great question. So like I guess I'll answer the second question first. and really like the just the cut and dry of it is if we look in the second chapter of the 2023 version of NFPA 70B, it actually cites NFPA 70E as a reference. And so when we think about these two documents, you can think about NFPA 70E as how do we protect our people when they work in and around electrical systems.

Scott Fowler

Sure.

Jordan Schlittler

And 70B is more about how do we protect the equipment and making sure that that equipment functions appropriately when our people are interacting with it. So 70E is about

protecting people, 70B is about the equipment in which those people interact. So in as the as the famous Forrest Gump would put it, 70B and 70E really go together like peas and carrots.

As far as like specific complements within the two standards, complement it between 70B and 70E really is where 70E requires users to consider the condition of maintenance when performing a risk assessment, and we perform these risk assessments when we're gonna do energized work. So that condition of maintenance and that risk assessment gets annotated on an energized work permit. So that's one example of where you see requirements of 70B and 70E coming together.

Also in an arc fault event, we understand that time, which we measure in cycles, is a critical component of the arc flash equation. And we need to trust that the upstream overcurrent protective device will recognize an arc fault and interrupt the circuit as quickly as possible. And in this world, fractions of seconds mean all the difference in in the effectiveness of a of a human's protective system.

So can we trust that the equipment will function the way that it's supposed to and if a fault does happen are we adequately protected in the form of the of the clothing that we're wearing. So yeah, the two go together very, very well.

Scott Fowler

Let's talk a little bit more about 70B. You touched on it a little bit there, but what are the core requirements that that the folks out there really need to know about?

Jordan Schlittler

Yeah, so those that maybe aren't as familiar with 70B would maybe just think, well this seventy B speaks to thermography. And it does. Thermography is a part of it, but really the core requirement of 70 B starts in chapter four and it it's all built off of this electrical maintenance program, what 70B calls an EMP.

So that's the core requirement. it centers on establishing and implementing an electrical maintenance program, and it's one that keeps electrical equipment safe, reliable, and operating as it's intended. So, you know, it according to the manufacturer's recommendations, and you'll see that a couple times at NFPA 70B.

There's nine elements that are required in an electrical maintenance program, and I've summarized some of them and listed out the full complement here for others, but the

The first requirement is establishing an electrical safety program that addresses the condition of maintenance. So again, there's a parallel there between 70B and 70E. The second element is personnel responsible for the implementation of the maintenance program. The third is analysis of electrical equipment and documentation of maintenance priorities. Four is the development of maintenance procedures.

And then followed by creating an inspection, testing and servicing plan, documentation and records for maintenance, equipment and personnel, corrective measures, implementation and documentation, maintainability, and then the final element is a program review and revision for continuous improvement. So all of those nine elements combined together is what 70B calls your electrical maintenance program.

Scott Fowler

Let's talk a little more about 70B, kind of building off of that. And Wes, you know, what is for you like what's the driving focus towards NFPA 70B?

Wes Maertz

Yeah, I mean, we've been getting a lot of focus toward 70 B. you know, in in our roles, we have been getting a lot of steady increase from maintenance managers and safety managers across the country, you know, asking about 70 B. So as we identified earlier, you know, Jordan shared a little bit about the requirements in 70 E and 70 B complementing each other.

In the 2023 edition of 70B, when that came out, actually was issued back in late 2022 and became effective in January of 2023. Prior to that, it was a recommended practice. So all previous additions to that was titled as a recommended.

Actually, right on the front of the standard, if you read it, it says recommended practices. Going forward with this new addition in 2023, it now says a standard. So it goes from recommended to standard. So I think a lot of maintenance managers, safety professionals now see that as an extra step saying it's now a standard and requirement.

Lot of people were referring to it earlier because it is the guiding document for maintenance and doing the steps that you need to do. additionally, a lot of people didn't know since the 2009 edition of 70E, it actually referenced 70B. So that's where you actually get the link between the two. actually, if you look in chapter two of 70E, that's the maintenance section.

So 70E always had a maintenance chapter in it, but they always in a notation in there, it's actually an article 200 of 70E, they actually reference 70B. And the newest edition of 70E, which has come just came out, the 2027 edition, if you look at that same note that's always been there in that chapter two, it's now referencing standard, no longer a recommended practice. So I think that's driving more attention to 70B now.

Scott Fowler

Gotcha. Go ahead, Jordan.

Jordan Schlittler

Yeah, so really so like when the standard for seventy B came out, oftentimes folks would like they thought, well maybe this is like people had the impression that 70 B was new, but really 70 E or 70 B predates NFPA 70E. So it's an older standard even than the NFPA 70E standard.

So it's been around for a long, long time. The big change that brought it over to a standard is now we've added language like shall into the regulation. So if a regulatory agency wanted to adopt it as their own, we'll just you know take OSHA for example, that the language is now written within 70 B, that a regulatory agency could adopt it.

Scott Fowler

Jordan, you talked earlier about, you know, the condition of electrical equipment, risk assessments and stuff like that. So going a little deeper into that topic, Wes, I'm curious, you know, how does the condition of electrical equipment, you know, as addressed in 70B influence those risk assessments required by 70E?

Wes Maertz

Yeah, yeah, it's really a direct relationship. So many of us have, you know, if you go onto YouTube, you know, we've all done training on electrical safety. And one of the things that we all put into our training is one of those dramatic videos. You know, you see somebody racking a breaker, turning a switch, and all of a sudden you have a big fireball in front of you.

Most of you probably what you've seen, or if you've done incident causation analysis on these, or you can just look at the video, you can tell it's a failure of the equipment. The equipment it because it is mechanical in nature. So mechanical switches can fail and they will fail in there. So where 70B comes into play, it really talks to the condition of that equipment. So you know, if you establish a maintain it through 70B, the guidelines that are laid out that Jordan talked about in the requirements, that directly dictates the likelihood of a failure and the overall safety calculations that play into the 70E.

So Jordan had mentioned earlier when you do a formal arc flash risk assessment, when you do an incident energy analysis, what plays into that directly is the number of cycles, you know, the condition of the equipment.

So on the equipment itself, you have, the specs, the manufacturer specifications. So based on the condition of that equipment, 70B dictates three conditions in there. They talk about a physical condition, they talk about the critical condition, and the operating environmental condition.

So how you rate that equipment based on those conditions will dictate how often you do some of the requirements in the 70B that Jordan kind of laid out starting in chapter four. So how often you have to do it, for example, how often do I have to do that infrared thermography? if your conditions are poor you have to do it more often in the standard.

So if you think about it, I kind of relate this to how you do maintenance like on your car every you know everybody has their car you take it in and you do regular maintenance on it because a car is a mechanical item you want to go take it in and do the regular maintenance why do you do it you do it because you don't want it to break down when you're driving to work every day.

So everybody has the owner's manual that I'm sure they read very carefully in their glove box in their car, and in a chapter, it will detail what is the maintenance. How often are you supposed to do it? Everybody knows that you have to do an oil change every X number of miles. But it also goes into more detail of different things you should do.

And that's similar to what 70B does for your electrical grid in your workplace. You need to do certain steps, certain things based on what you do. And if you do that, you know, when you go to rate the risk level of a certain piece of equipment if it's less likely to fail because you're doing these steps, less likelihood of an incident from happening.

Scott Fowler

Sure. Let's talk more about that. The car example is you know, maintaining your cars is a good example. And you know, Jordan is thinking more about that that deferred maintenance, you know, when we're, you know, you're talking about electrical systems in and workplaces, you know, what can happen when that goes wrong, when that maintenance is, you know, delayed or skipped, you know, how can those deficiencies, you know, increase the risk of, you know, arc flash or shock hazards for someone's workforce?

Jordan Schlittler

Yeah, I'm gonna use Wes's car example. but so real quick, so I like how does it increase shock hazards for workers if we're delinquent on our maintenance? So again, fault clearing time, if you look in the ArcFlash PPE tables in NFPA seventy E, very small increases, like fractions of seconds, make a huge difference in the amount of heat felt measured in calories per centimeter squared during an arcing event.

So tenths or hundredths of a second for fault clearing time make a huge difference. So if our gear isn't if it's not functioning the way that the manufacturer says it's supposed to, significant ramifications for the for the folks that are interfacing with it.

As far as the costs of deferred maintenance, to go back to the vehicle example, again there's direct and there's indirect costs. And my particular way, I guess, to try and reduce this would be like think about the brakes on your vehicle. So really it's not if your brakes will eventually fail, it's when will they eventually fail?

And so like we acknowledge this, and so we have maintenance intervals where we're doing inspections on our brakes, right? And we're monitoring the degradation of those brakes over time, and eventually those brakes get to a point where we say, Okay, we are going to schedule a shutdown so that we can perform the maintenance in a safe environment.

And of course, then that allows me to de-conflict certain things in my life, like I'm gonna pick the day that it's gonna happen. I'm gonna make sure that my wife can take the kids to school, right? Because my vehicle's gonna be at the dealership. I'm gonna pack a lunch with me, right? So that there is indirect cost, right? I'm gonna be without my vehicle for a small amount of time, but it's planned and I'm forecasting it. versus the I'm gonna run those brakes until they fail.

If Murphy and his laws have anything to say about that, those brakes aren't gonna fail when it's convenient. It for me, they're gonna fail in the middle of the night on a family trip when I'm in the middle of nowhere in a rainstorm, right? And so, like when those brakes have an unplanned failure, an unplanned shutdown here in this case, right, the direct cost of the brakes, in this case, pale in comparison to all of the indirect costs, right?

I'm gonna have a very unhappy wife. I'm gonna have to have a I get a hotel room. I have no idea how long I'm gonna have to be in that hotel room, right? All while my Airbnb is sitting there paid for and unused, right? And like on down the line it goes. We can use that same type of thinking when it comes to our electrical system. when these arcing events happen,

Our systems in a lot of cases, we have a shutdown now and it is an unplanned shutdown. And anyone who's ever had to experience this before knows that you just don't go rolling through the drive-thru and get new switch gear to be installed.

So those indirect costs of downtime and lost production, it's almost tough to wrap a number around some of these because those figures get to be so huge. So yeah, if you're if you're looking for a way to justify this to yourself or to you know to a plant manager, you can think about it along the lines of something as simple as maintaining the brakes on your car.

Scott Fowler

Well said. you know, talking, you know, more about the importance of that maintenance, I know NFPA seventy E emphasizes, you know, establishing an electrically safe working condition, you know, before work begins. And Wes, you know, how does a robust NFPA seventy V maintenance program you make that process more reliable and predictable?

Wes Maertz

Yeah, sure. I mean this this is extending off what Jordan was just talking about. I heard him say a few key words there. Trust, planned, forecasted. the main objective of 70B is about

How do you know if something's reliable and predictable? So if you know it's reliable and predictable, it's going to perform according to what that switch says is the clearing time. So if you don't actually do the steps, you know.

Do the checks, do the regular maintenance. How do you know how reliable or predictable something's going to be unless you actually do something? And that's what 70B actually does. So again, it's a direct relationship. So again, how you evaluate the condition, how old it is, how often you've been doing your steps.

If you're doing what it says you're doing, you know you're within the manufacturer's specifications. If it tells you the clearing time, you reliably can count on that. So when you do your incident energy analysis for that piece of equipment, you know.

That is the amount of energy that will be produced at that label because that upstream device you can know that it predictably and reliably will perform according to the manufacturer's specifications. So, as Jordan was mentioning, you know, when you reference, a lot of people I know reference the table method in the standard in 70E, but a lot of times they ignore.

The notes at the bottom of that because they talk about it needs to be within certain clearing times. If you don't meet those specifications, you have to use the incident energy analysis. And a lot of people don't know those clearing times because they don't know how

predictable or reliable that piece of equipment is. That's pretty bad in a safety world. You don't want to make assumptions like that.

So I would want to know how reliable or predictable a piece of equipment would be. And again, doing regular maintenance. So routine servicing, like preventing you know, trip mechanisms, switches, you know, contacts from seizing up, you know, they do get dirty. you know, if you don't use them very often, just think about it.

If you go in the basement of your house and you know, you have circuit breakers down there, all of us probably have had to replace a circuit breaker at one time or another because it just doesn't quite click over clean enough because you don't move them very often or and they do get dirty in there. It's no different in the workplace.

So that's why you go through these steps to make sure that when that time comes, you know, if an incident does happen, you want that switch to reliably open that quickly when you need it to. So going through those steps, knowing predictable and reliability is the thing to do.

Scott Fowler

Let's talk a little more about equipment, particularly PPE. And Jordan, you know, when you're selecting PPE under seventy E, you know, should the actual condition of the equipment, you know, as determined, you know, through those seventy B inspections, you know, should that affect the decision-making process? And you know, if so, how does that work? Or how should that work?

Jordan Schlittler

Yeah, it should. So this is the part of the standard that gets a little bit more ambiguous though, right? 'Cause so evaluating the condition of maintenance is what factors into our risk assessment, right? So how likely is it that the equipment is gonna fail? And if it does fail, how severe is that failure gonna be as far as like hazards now associated to the end user?

So when we estimate the likelihood and severity, aka conduct a risk assessment, we take into account the design of the equipment and the condition of that maintenance. When we determine that additional protective measures are required, 70E requires that we select them based on a hierarchy of controls. So again, like all the safety people in the room here listening today, they're like, yes, hierarchy of controls. I'm familiar with this. 70E has a few more, one in particular in the hierarchy. they include awareness in the hierarchy of controls. It's firmly planted right there about in the middle.

But again, so it when the day comes where we are performing electrical work and we're removing a panel cover and we take a peek inside and we notice that there's corrosion in there and we notice that maybe there's been rodent infestation and like other signs in that equipment where we say, I don't think I trust this equipment to function the way it's supposed to be.

Everybody in the room here and everyone listening needs to fight that initial urge to go reach for the higher rated suit. Right, so I don't reach for the forty-calorie suit, right? Or even the hundred-calorie suit, right? It doesn't matter where you're looking at these hierarchy of controls, PPE is always the last line of defense. We're not really doing anything about the hazard when we put on a higher rated suit. All we're doing is we're upgrading our garment and providing maybe a better shield against that hazard.

So, once we start conducting that a risk assessment and we notice that there are things in here that we're not willing to accept based on that condition, then let's work our way quickly up the hierarchy of controls and take a good hard look at elimination, which requires us to establish an electrically safe work condition, also known as de-energization. Right?

That's where we're that's where we're looking to get. It doesn't matter if you're looking in 70E, it doesn't matter if you're looking in OSHA. If it is beyond a place where we are willing to accept the risk. Don't look for higher levels of PPE.

Look to eliminate the hazard as much as you can. And in this case, it's let's forecast and plan to de-energize the equipment. And at that point, once we verify that there's no energy there, we can take all of that PPE off. We don't need it any longer because there's no longer a risk for shock and arc flash.

It's great for the individual worker. It's great for the end user and the owner because now we are we're shutting down, but we're doing it in a way in which we're planning for it. And there's far less costs associated with doing work in that regard.

Scott Fowler

Yeah, another important aspect of this, you know, and a lot of work that safety professionals do is the record keeping. And Wes, I'm curious, you know, what maintenance records or documentation from 70B are most valuable, you know, for safety professionals to show that you know they're in compliance with 70E and they're, you know, taking those steps that they should be taking to address these hazards.

Wes Maertz

Yeah, I think all the safety professionals out there watching this know that, you know, in in safety world, OSHA world especially, if it's not documented, it never happened. So, no change here with 70B. It does highlight certain things. They really focus on what they call conditions of maintenance.

So things like, number one, overcurrent protection device testing and calibration. So, anything that you're doing when you're actually, you know, involves circuit breaker testing, verifying, clearing times, aligning to those manufacturer specifications, anything you've done, you want to document that.

You know relay calibrations so basically what you're doing is validating that the engineered specs on that piece of equipment you know it says we're in small letters you're validating that that is what it's still currently able to do which ultimately which we've been talking about then leads to you're calculating your incident energy levels you know it's going to reliably and predictably operate according to those conditions.

Another thing is the conditions we talked about this earlier the three conditions in there when you're predicting risk level we talked about physical condition criticality of condition and operating condition you want to document all that when you're going through and doing those so conditions is another one other ones are one-line diagram up upgrades

NFPA 70E says you have to update your one-line diagram at least every five years. We'd recommend any other change that you do in your electrical grid. Jordan and I were talking about this earlier. That you know how hard it is when you're thinking about doing a lockout tagout program and you're writing a procedure.

And you have to trace where that circuit goes. Where does that switch go? If you don't have an updated one-line diagram, that's the truth of source there. That's where you go to trace where that circuit is. If that's not updated, that can make writing procedures a whole lot harder when it comes there. So you want to make sure you document that. Any corrective actions that you do.

So if you fix something, make sure you record that. you know, if you didn't if you fix it, record it. another one Jordan mentioned earlier, one of the main requirements in 70B is infrared thermography. if you do the, you know, the scanning of the equipment to ID hotspots, loose connections, etc., you want to document that as well because thermal issues are typically a leading precursor to a failure of a piece of equipment.

So as you document that, that's an excellent notation. Actually, in in in the 2015 edition of 70E, and newer since the newer ones, so the about the last three or four editions, they

actually put a note in chapter two. So it's in that article two hundred, it's actually article two five. They actually make some recommended practices for documentation. It's pretty basic. They talk about actually labeling the piece of equipment. So if you imagine a circuit breaker panel, on the outside of that panel, you'd actually just put a little decal on the outside where someone could mark the last tested date, who did the testing on it. So it's a real basic form of documentation to show, hey, this is when the last test was performed.

Jordan Schlittler

Yeah. Yeah, so like i incident energy analysis is a large undertaking, right? To have an ArcFlash study performed. So like both NFPA 70E and 70B require end users to take upon themselves pretty large projects in terms of their scope and sometimes in their finances as well. Like these are capital expenditure projects, the return on investment for a lot of these though is both seventy E and seventy B require something called coordination, right? The circuit tracing component of it where now we know where things are fed from.

So complying with seventy B and seventy E for your end users now, gone are the days of searching around the plant for hours trying to find a breaker so that you can appropriately shut something down. You don't have to guess any longer. You don't have to send the apprentice to the other side of the plant and have pop a bunch of breakers to try and locate where things are fed from because that coordination is already built in here as part of your 70B and 70E programs. So think of it as a nice, you know, third order or four.

Scott Fowler

Sure. As we get ready to wrap up here, I want to get both of your thoughts. You know, for those out there, you know, watching and listening, you know, looking to, you know, strengthen the, you know, the safety and reliability, you know, as it you know, pertains to to these standards, you know, what advice would you give them, you know, to help make sure they're in compliance with 70B's requirements?

Wes Maertz (28:31.907)

I'll jump into that one first, I'll take that Jordan. One of the common asks that I get a lot from customers you know as they come in we talk about there's more people driving towards 70B in a lot of places they've kind of been doing stuff but they don't know kind of where they're at so there there's services or providers out there that can do a seventy B gap analysis for them. It's a great way to start to say, hey, I don't know where I'm at, I don't know where my program is.

I know I've been doing something, but I don't know what I'm doing is within the guidelines of 70B. So doing a gap analysis is a great way to, you know, kind of help jumpstart and

implement the requirements of an EMP and find gaps in existing programs. And then additionally, it will identify any kind of procedures that either A are working well and can service as a model in other areas.

So it's a good starting document. So you know you can always reach out to, you know, where you wherever you get your electrical equipment, providers, you know, that that's a great way you can come in and just kind of lay the groundwork out and tell, hey, you're doing great here. Maybe you need to do a little bit better here. And it gives you that d roadmap to compliance a little bit better.

Another one I just I wanted to jump on too, we talked about documentation. So we had talked about some of the best practices, just putting labels on the equipment. there's a lot of great new you know providers out there that make their maintenance managers' lives a lot easier.

So think of it instead of just putting a standard label on there, there are tracking software out there that you can actually put the same label on there, but it's a QR code that then you can just take your phone, scan it, and then it'll pop up right on the screen. It'll tell you everything that needs to be done on that piece of equipment. You can put in the inspection cycles, if it's an IR thermography scan.

So, it's a great way that you can track that. And then the administrator, maintenance manager, or safety manager can go into the dashboard and can easily pull up their entire grid of electrical equipment and it can show and spot like this stuff, these equipment needs to be done, or we're overdue in these other areas. So it's just a real easy way to track. So a lot of great stuff out there.

Jordan Schlittler

I'm gonna put in a shameless plug here for the National Fire Protection Association and hop online and get yourself a copy. right. So like it great that you listen into the podcast and maybe, you know, Wes and I are planning some ideas into your head and you know, maybe y you come away with this with more questions than you do answers. Well that's a good thing.

Go get yourself a copy of the publication and get into the chapters and start reading and find places where you can, basically, take their ideas and start building your own electrical and maintenance program. a couple places, qualified person training comes up in both 70E and 70B. So if you're just looking for a place to start, start with educating your people, right? Awareness, right, is factored right into NFPA's hierarchy of controls. So get your people trained, make them aware.

And that's already putting you in a step in the right direction. And then, you know, of course, like there's also, you know, like be looking to incorporate thermography in into your electrical maintenance program, right? That's those cameras, they're they are an investment. But man, I tell you what, yeah, you identify one hot spot in there and prevent a failure point before it actually occurs, you've just paid for that camera.

Not to mention the improvement in workplace safety as well. So, you know, like the worker that you just saved from experiencing a potential arc fault event because of that thermography study that you did, man, it's it doesn't take long for this time and these resources to pay huge dividends.

Scott Fowler

Very well said, 'cause yeah, at the end of the day, this is what this is all about. So well thank you both so much again for coming on. You know, these are critical aspects of workplace safety that, you know, safety professionals need to address and I really appreciate you coming on and talking about how seventy E and seventy B can help do that. So thank you so much again.

Jordan Schlittler

Thanks a bunch, Scott. Had a great time.