Workplace Safety
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Mastering Electrical Safety: Working Hot and the Requirements of Article 130

While working in an electrically safe work condition is important, there are times when working hot is necessary. Make sure you're following the requirements laid out in Art. 130.

by Mark Lamendola

Key Highlights

- Only qualified persons should perform hot work, and an energized work permit must be completed to ensure safety protocols are followed.
- Conduct thorough shock and arc flash risk assessments to identify hazards, boundaries, and appropriate protective measures before working on energized equipment.
- Use PPE as the last line of defense, selecting equipment based on detailed tables and standards, and ensure proper storage, inspection, and maintenance of all protective gear.
- Always consider de-energizing circuits to avoid unnecessary risks; working hot should only be done when explicitly permitted under specific exemptions in Art. 130.
- Proper planning, documentation, and adherence to safety standards help prevent unplanned shutdowns/equipment damage and protect personnel from severe injuries.

Ideally, you will always put an electrical system or electrical equipment in an "electrically safe condition" (de-energized) before performing work on it. But doing so isn't always possible or practical, so sometimes you must "work it hot."

If you're tasked with working hot, determine whether the reason aligns with the four exemptions found in NFPA 70E Sec. 130.2(C), such as testing. If not, don't work it hot. You aren't doing anybody any favors if unnecessarily working hot results in an unplanned shutdown, which is far more costly than a planned shutdown.

If the equipment isn't energized, you have no risk of electric shock, arc flash, or arc blast. You also have no

Mastering Electrical Safety: Working Hot and the Requirements of Article 130

risk of damaging equipment due to inadvertently shorting two phases. There's no risk of adverse operation, which can harm people, the environment, or other equipment. If equipment is energized, then you have may have all of these risks. By following the requirements of Art. 130, you can reduce both the likelihood and severity of these risks.

If the system is under 50V, the electric shock and arc flash risks aren't there, so following Art. 130 isn't warranted. But you should still follow the standard precautions for protecting that equipment from human error and for preventing adverse operation.

At 15 pages long, Art. 130 isn't something you can glance at and understand. It takes some study. This overview will help your study of Art. 130 be more effective, or it may deepen your understanding if you've already studied it.

These four requirements apply to working hot:

1. Only qualified persons are allowed to do it.
2. An electrical work permit must be completed. This is the first of three core strategies [Sec. 130.2].
3. An electric shock risk assessment must be performed. This is the second core strategy [Sec. 130.4].
4. An arc flash risk assessment must be performed. This is the third core strategy [Sec. 130.5].

Additionally:

- PPE is covered in Sec. 130.7. This is highly detailed and makes extensive use of tables. When applying Art. 130, you may spend a lot of time determining what PPE is appropriate for that particular work.
- "Other precautions" are covered in Sec. 130.8. This covers such things as illumination, scope changes, and blind reaching. Work within certain specified clearances (including overhead lines) is covered in Sec. 130.9.
- Underground lines are covered in Sec. 130.10.
- Cutting and drilling are covered in Sec. 130.11. The key concept is to identify potential energy sources before drilling or cutting. Finding an energized cable with your power drill may prove to be a bit too exciting, to say the least.

Energized work permit

An energized work permit is required when the work is performed on an energized circuit [Sec. 130.2(A)] that isn't exempted in Sec. 130.2(C).

Because the employee fills out the permit and the employer is the one managing the program under which the permit is issued, many people believe the employee is applying for permission to do the work. A better way to think about it is the employee is giving the employer permission to have the work done. This second perspective prioritizes safety over job completion. Instead of standing in the way of work, the permit allows work to proceed (if its conditions are satisfied).

You'll find the nine elements of a work permit listed in 130.2(B)(1) through (9). For example, description of the work to be performed and results of the arc flash assessment.

Shock risk assessment

This assessment has three goals:

1. Identify electric shock hazards.
2. Estimate the likelihood of injury or damage, and estimate the potential severity. Take into account the equipment design, operating conditions, and condition of maintenance.
3. Determine if you need additional protective measures. Take into account the voltage, the boundary requirements, and the recommended (by NFPA 70E) protective equipment.

In doing this assessment, you must document what you find and conclude [130.4(D)] and determine the limited approach boundary [130.4(F)] and the restricted approach boundary [130.4(G)].

The limited approach boundary is the closest to the equipment that an unqualified person can get, unless the specific circumstances described here are met. Consider marking this boundary with yellow tape.

The restricted approach boundary is for qualified people. They can't take any conductive object closer to the exposed energized conductors or circuit parts than this boundary. How do you know where it is? You use Table 130.4(E)(a) and Table 130.4(E)(b). This boundary gets "erased" if the qualified person meets either of the two conditions stated in Sec. 130.4(G). For example, he is insulated or guarded from the energized conductors or circuits. Consider marking this boundary with red tape.

Workplace Safety ACADEMY

Mastering Electrical Safety: Working Hot and the Requirements of Article 130

Arc flash risk assessment

This assessment has the same three goals as the shock risk one, except it's for arc flash risk. The same parameters of what to account for apply, including the requirement to document everything [Sec. 130.5(D)]. As with the arc flash risk assessment, if additional protection measures are required, you must select and implement per the hierarchy of risk control identified in Sec. 110.3(H)(3).

If those additional measures include PPE, you must determine three things:

1. Appropriate safety-related work practices.
2. The arc flash boundary. This is the distance at which the incident energy equals 1.2 calories per square meter [Sec. 130.5(E)(1)], and you can use the incident energy analysis method [Sec. 130.5(G)] to determine this.
3. The PPE to be used within the arc flash boundary.

Table 130.5(C) is helpful in determining how likely an arc flash event is. This table is a set of four groupings of tasks:

1. Any operating condition — no likelihood of occurrence.
2. Any operating condition — occurrence is likely.
3. Normal operating condition — no likelihood of occurrence (only one task listed: operation of a circuit breaker, switch, contactor, or starter).
4. Abnormal operating condition — occurrence is likely.

This table has extensive footnotes, plus six Informational Notes.

The assessment is clearly a lot of work. The good news is it can be done once for a given piece of equipment. Then a label meeting the requirements of 130.5(H) can be affixed to that equipment. The method of calculating and the data to support the calculation must be documented.

Make sure you examine this documentation, rather than merely trusting the label. To err is human; to suffer an arc flash will truly ruin your day.

The label must be reviewed for accuracy at least once every five years. If any changes in the equipment render the label inaccurate, the label must be updated (it is best to remove or cover the label if it is not current). The equipment owner is responsible for maintaining these labels and the associated documentation.

PPE

Section 130.7 comprises one-third of Art. 130. Most of it addresses PPE, but it includes less than a page that deals with insulated tools, ropes, barriers, and so forth [Sec. 130.7(D)] Before determining which PPE is appropriate, go back to the hierarchy of risk control methods [Sec. 110.2(I)(3)]. There are six, and PPE is dead last. It's the final safety net, not the first line of defense.

Article 130 contains seven tables for PPE, and another for other types of protection:

1. Table 130.5(C). Arc-rated clothing and other PPE if you use the incident energy method.
2. Table 130.7(C)(7)(a). Maximum voltages for rubber gloves.
3. Table 130.7(C)(7)(b). Maximum test intervals for rubber gloves.
4. Informational Note Table 130.7(C)(14). Standards for PPE.
5. Table 130.7(C)(15)(a). Arc flash PPE categories, AC systems.
6. Table 130.7(C)(15)(b). Arc flash PPE categories, DC systems.
7. Table 130.7(C)(15)(c). PPE.
8. Table 130.7(E). Other protective equipment.

Three key considerations:

1. Employees must use protective equipment that is designed and constructed for the specific part of the body to be protected [Sec. 130.7(A)].
2. Requirements for specific body parts are in Sec. 130.7(C)(3) through (8).
3. All of this equipment must be properly stored and cared for — and visually inspected — before each use [Sec. 130.7(B)].

The right mindset

One reason often invoked for unnecessarily working hot is it saves time. But that idea is pure fiction. Unless exempted by Sec. 130.2(C), working hot requires conducting two hazard assessments and a PPE assessment plus filling out an energized work permit. You can skip all of that by simply de-energizing the applicable circuits.

Working hot also involves the risk of an unplanned shutdown due to inadvertently triggering some interlock or protective device, adverse operation of equipment, shock to personnel, arc flash, and arc blast. Production management would rather schedule

Mastering Electrical Safety: Working Hot and the Requirements of Article 130

a shutdown than bear the cost and inconvenience of an unscheduled one. And nobody wants a lethal incident.

Working hot so you can get away with not performing a lockout/tagout is a fool's game. Working hot entails more preparation time, higher preparation costs, and higher risk of high-severity occurrences. So working hot — not lockout/tagout — is what you want to try to avoid. If you can't avoid it, then implement the NFPA 70E Art. 130 requirements.

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