



099: Working Hot

Why this is important

Every time you work on energized circuits you risk an arc blast or electric shock. If you take the necessary precautions, you can eliminate the risks.

The potential harm

Temperatures generated by short-term contact with a circuit even as low as 120V can be 10 times higher than what it takes to cook your tissues.

It takes very little electricity to electrocute you. The amount of current it takes to light a 75W lamp is past the threshold of what it takes to cause fibrillation. When you think of fibrillation, think of your heart being rendered useless.

Electrocution burns take place from the inside out.

Contact time is an important determinant in the severity of damage. The less time, the better. Other factors that determine the severity of damage include voltage, resistance, frequency, and victim characteristics such as age, physical condition, and size, plus some environmental factors.

Shock characteristics

At 60 Hz, AC shock produces a tingling sensation that ranges from slight to violent.

DC shock produces a warmth sensation that ranges from warm to burning hot.

When current through your body reaches a certain point, it paralyzes your arm muscles so you can't let go. This is what people are talking about when they refer to "let-go current."

The let-go current threshold decreases as frequency increases. It takes less current to pass the let-go threshold when you are working on a 400 Hz UPS than when you are working on a 60Hz system.

Shock current path

The path the current takes through your body can determine whether you survive or not.

That's why we take measurements with one hand on the probe and one hand in a pocket, rather than with both hands on probes and a path established across the heart.

That's why we also try to eliminate pathways between feet and hands.

Your heart is on your left side. Thus, if you must choose a path that includes a hand and a foot, choose the right hand and foot rather than the left hand and foot.

Preventing electric shock

Working on de-energized circuits is an obvious way to prevent shock, but it depends on proper lockout/tagout, proper testing for voltage, and using safety grounds.

Non-compliance with the requirements for ensuring circuits are de-energized is rampant, and the body count from non-compliance is high.

Using the appropriate PPE and following hot work procedures is your first line of defense, not your last.

Discussion leader duties for this session:

Obtain various electrical PPE, such as flame resistant clothing, to discuss proper use during the discussion session.

What this Safety Talk covers:

How to reduce the risks of an arc blast or electric shock.

Discussion notes :

Why is it important to know the principles of working hot?

What are characteristics of DC shock?

Regarding hands and feet, what is the proper way to take measurements, and why?

How hot can an arc blast get?

Is the pressure wave from an arc blast powerful? How so?

What are some clothing and PPE issues, in regard to arc flash and arc blast?

How can you prevent an arc fault in the first place?

The heat from an electric arc can reach temperatures four times as hot as the surface of the sun.

The pressure wave generated by an arc fault can hurl you away from the heat source, but usually causes other injuries also. In worst case scenarios, the pressure wave acts like a giant hammer. The pressure waves are sometimes strong enough to level concrete walls.

Wear the required PPE, such as a flash suit, hood, and face shield.

Wear clothing resistant to flash flame wherever exposure to an electric arc flash is possible. In the several seconds it takes to remove clothing or extinguish flames, you can be subject to deep and possibly fatal burns.

Reduce the likelihood of arc faults to begin with. For example, make test connections one lead at a time to prevent creating an ionized path that completes a circuit between an energized terminal and ground. Another way is to remove as many loads from the equipment as possible before working on it.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's part of a bound notebook.