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Welding From Suspended Scaffolds

When arc welding needs to be done on a suspended scaffold, it presents unique hazards that need to be identified and dealt with. Known hazards on all welding job sites include: electric shock, fumes and gases, arc rays, fire and explosion, flying (and hot) metal parts, and magnetic fields. In this article, we will only address the hazards dealing with electric shock in relation to the suspended scaffold.

Electric shock can be received from the primary or secondary circuit. The primary circuit is found inside the welding machine and can be 110 to 480 V. Any contact with a live wire or other electrically "hot" component inside the welder, or a bare wire leading to the welder, can lead to a hazardous high voltage shock. An improperly grounded welding machine combined with a faulty circuit can also lead to a high voltage shock. The secondary (welding) circuit is a much lower voltage and usually in the form of direct current (DC) as opposed to alternating current (AC). AC is more likely to stop the heart than DC, plus it is also more likely to make the person holding the wire unable to let go. When touching a live electric part in the secondary circuit with one hand and a grounded metal surface with the other, you will receive a mild shock if the system puts out up to 30 V DC. However, some circuits can put out up to 100 V and some provide an AC output. In that case, the shock will be severe and even 50 V or less can potentially cause injury or death. Be aware that the voltage at the electrode is highest when you are not welding.

Some general safety precautions for any welding job site, but especially when working off a suspended scaffold are:

- Do not touch live electrical parts.
- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself by using dry insulating mats or covers.
- Properly install and ground the equipment.
- Frequently inspect input power cord from damaged or bare wiring.
- Turn off all equipment when not in use.
- Do not touch an electrode if you are in contact with the work, ground, or another electrode from a different machine.
- Clamp work grounding cable with good metal-to-metal contact to a workpiece as close to the weld as practical.
- Insulate work-grounding clamps when not connected to a workpiece to prevent contact with any metal object.
- Significant DC voltage exists after removal of input power on inverters. Turn off inverter, disconnect input power, and discharge input capacitors according to manufacturer's instructions.

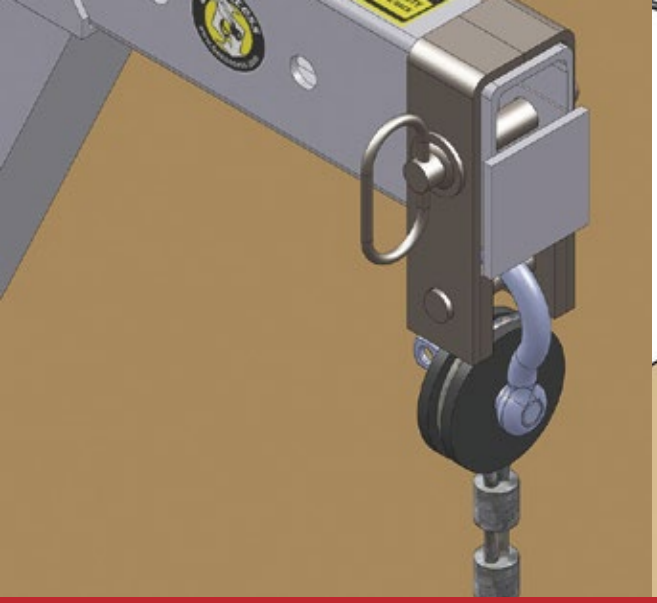


Illustration 1, insulated thimble

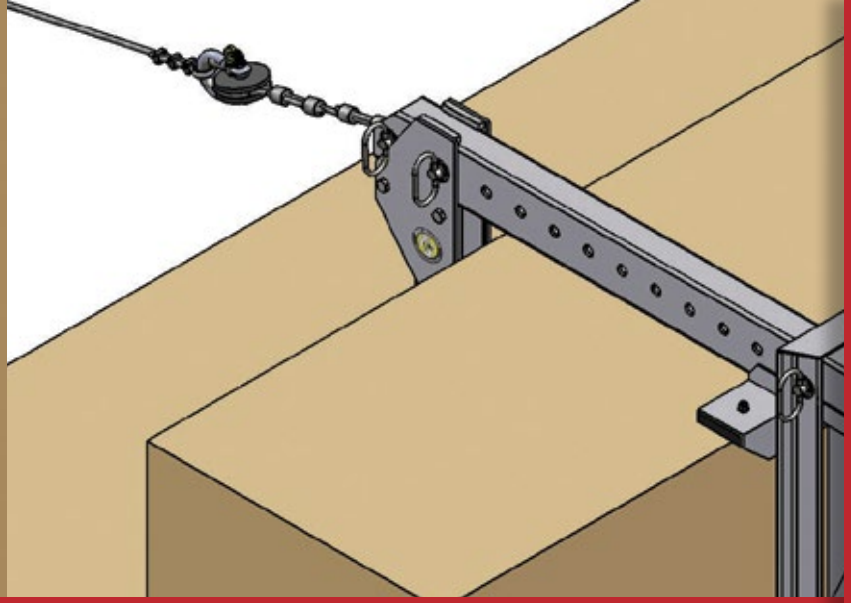


Illustration 2, insulated tieback cable

These and other general safety precautions can be found in the operator's manual of the welding machine.

A suspended scaffold adds additional complications as the weldor will be working off a metal platform suspended by steel wire rope, providing a perfect path for a stray welding current to go where you don't want it go. Note that welding current can go up to 250 or more amperage, ready to melt whatever metal is in its path. OSHA has identified these unique hazards related to suspended scaffolds and devised standard 1910.451(f)(17) to deal with this. Let's go through each paragraph and apply these standards to a modern day modular platform assembly by means of sample graphics.

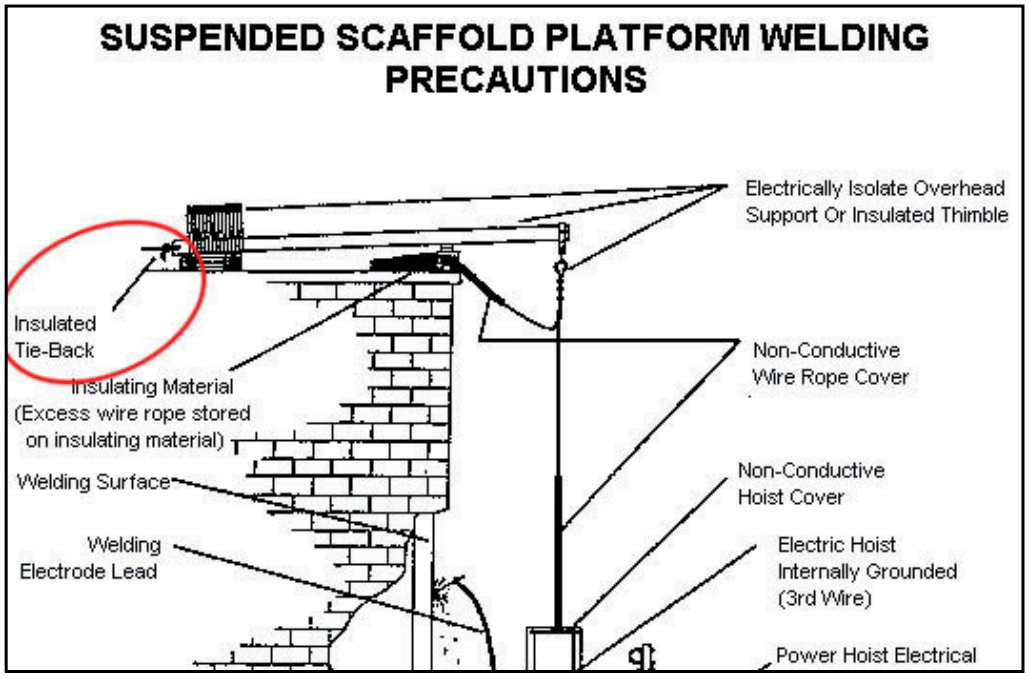
"*1926.451(f)(17)(i): An insulated thimble shall be used to attach each suspension wire rope to its hanging support (such as cornice hook or outrigger). Excess suspension wire rope and any additional independent lines shall be insulated from grounding…*"
Explanation: Preserving the condition of the wire rope is the most important thing on a suspended scaffold as its potential failure is the single greatest hazard. Any accidental contact of the welding stick or other live electrical part with a grounded wire rope will result in immediate and catastrophic damage to the wires and strands. Breaking of the wire rope can result immediately, or after brittle wires bend and consequently break inside the hoist. Insulating the wire rope from ground is extremely important and the first step is to install an insulated thimble on all suspended and auxiliary wire ropes.

See Illustration 1, insulated thimble

The excess suspension wire rope they talk about is the extra wire rope left over and stored on the roof when using fist grips to terminate the wire rope. This should be stored on a floor mat with insulating properties. Industry practice has shifted mostly toward using swaged fittings without any excess rope at the termination point, so that part may no longer apply.

The tricky part is the wording: "any additional independent lines." Not only does this apply to any auxiliary (second) wire ropes rigged for additional safety, it also applies to tiebacks. Evidence of this can be found in the old drawing that accompanied this standard that clearly shows a reference to an "insulated tie-back".

See Illustration 2, insulated tieback cable



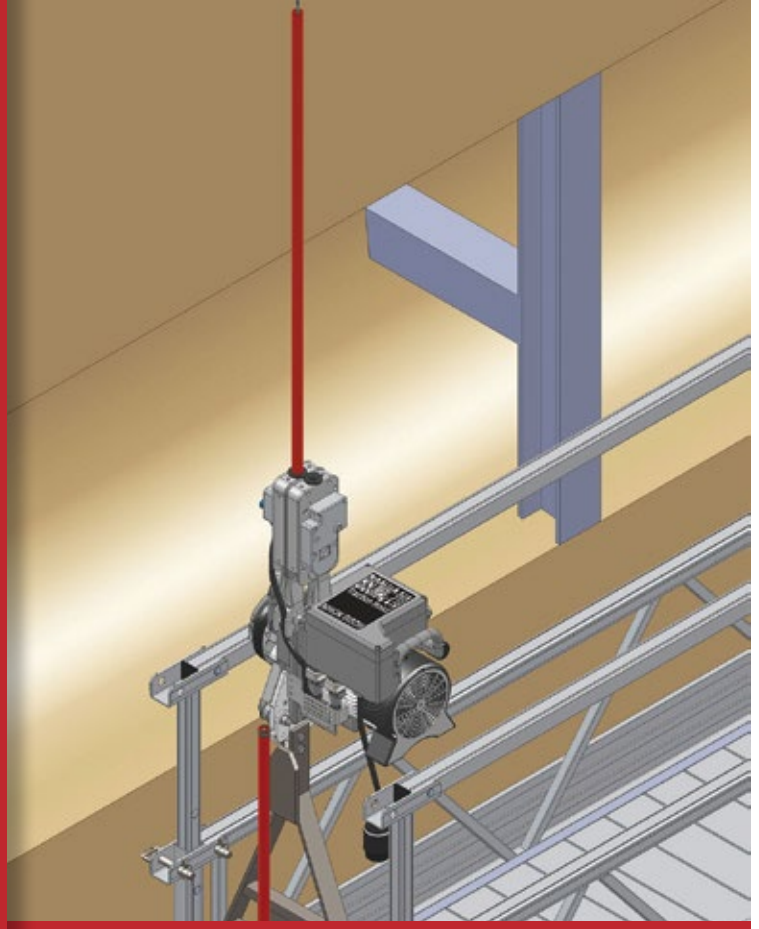


Illustration 3, insulated tubes

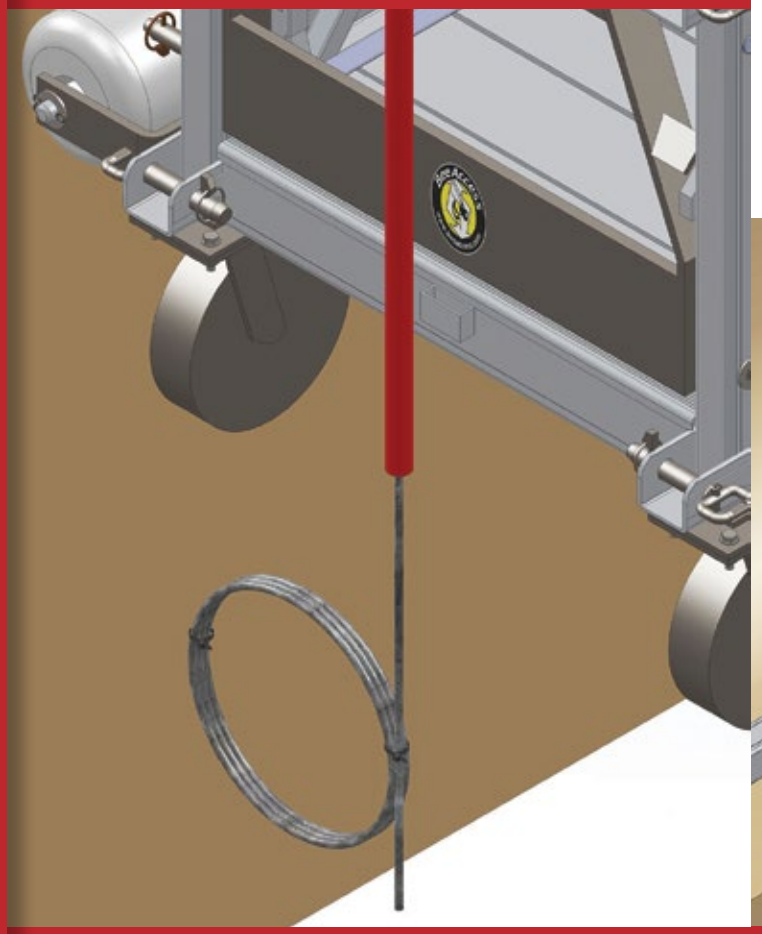


Illustration 4, coiled up tail line

*"**1926.451(f)(17)(ii)**: The suspension wire rope shall be covered with insulating material extending at least 4 feet (1.2 m) above the hoist. If there is a tail line below the hoist, it shall be insulated to prevent contact with the platform. The portion of the tail line that hangs free below the scaffold shall be guided or retained, or both, so that it does not become grounded…"*

Explanation: To prevent a welding torch or other live electrical part from coming in contact with the wire rope, an insulated tube must ride on top of the hoist. To prevent the exiting wire rope from coming in contact with the platform, attach a tube with insulating properties from the exit area of the hoist to just below the platform.

See Illustration 3, insulated tubes

To prevent the tail line of the wire rope(s) from grounding, either coil up the excess length, or use a wire winder.

See Illustration 4, coiled up tail line

***1926.451(f)(17)(iii)**: "Each hoist shall be covered with insulated protective covers…"*

A welding torch, or other live electrical part coming in contact with the hoist could damage the hoist and/or the wire rope inside. Check with the hoist supplier on the proper cover to use.

See Illustration 5, insulated protective hoist cover

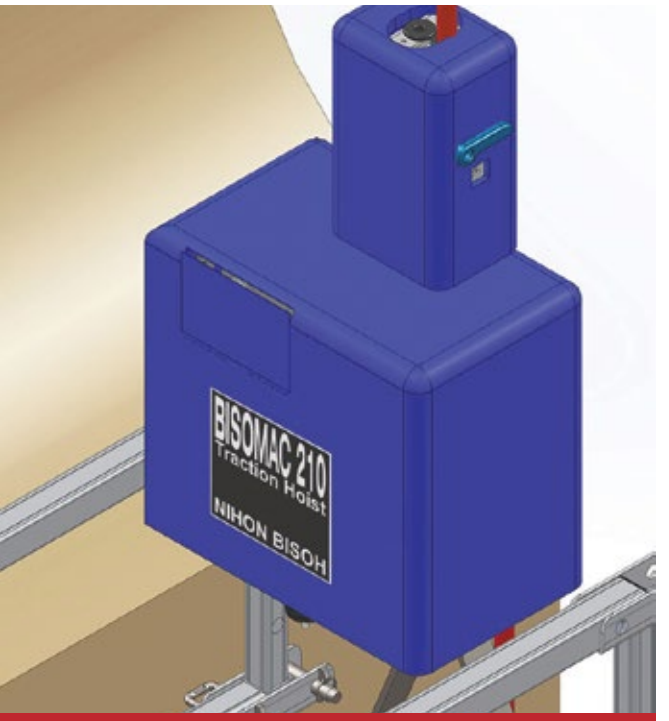


Illustration 5, insulated protective hoist cover

*1926.451(f)(17)(**iv**): "In addition to a work lead attachment required by the welding process, a grounding conductor shall be connected from the scaffold to the structure. The size of this conductor shall be at least the size of the welding process work lead, and this conductor shall not be in series with the welding process or the work piece…*
1926.451(f)(17)(v)
If the scaffold grounding lead is disconnected at any time, the welding machine shall be shut off; and…

*1926.451(f)(17)(**vi**)*
An active welding rod or uninsulated welding lead shall not be allowed to contact the scaffold or its suspension system."

Illustration 6 shows the grounding conductor. Make sure it is long enough to account for normal movement of the suspended platform.

See Illustration 6, grounding conductor

The process of grounding the platform to the work surface seems counter intuitive as it defeats the purpose of using insulated thimbles on the suspension wire rope. Any accidental contact of an electrode with the suspension rope (above or through defective insulating tubes) or platform could create an arc.

A contractor raised this question in 1998. The following is the reply from OSHA in a standard interpretations letter from December 10, 1998:

*"The purpose of the grounding requirement is that, in the event of a fault, where there is an accompanying failure -- **including a failure in insulating material** -- the electrical energy would go to ground rather than through an employee on the scaffold. While a perfectly insulated scaffold would prevent an electrical arc to a scaffold component, the standard addresses the possibility that problems may arise in the planning and installation of insulators, as well as with the insulating devices and the welding equipment itself. For example, a fault in the welding equipment could create an electrical potential from one part of the welder through a portion of the scaffold*

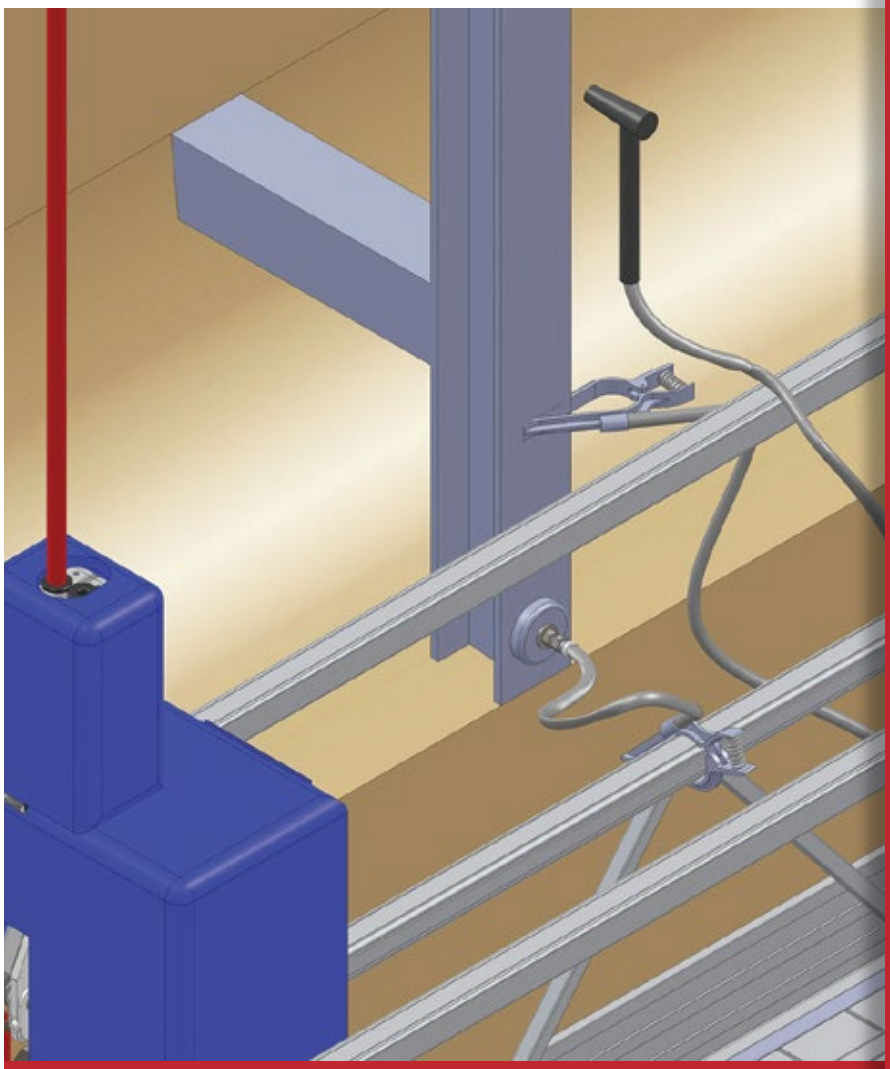


Illustration 6, grounding conductor

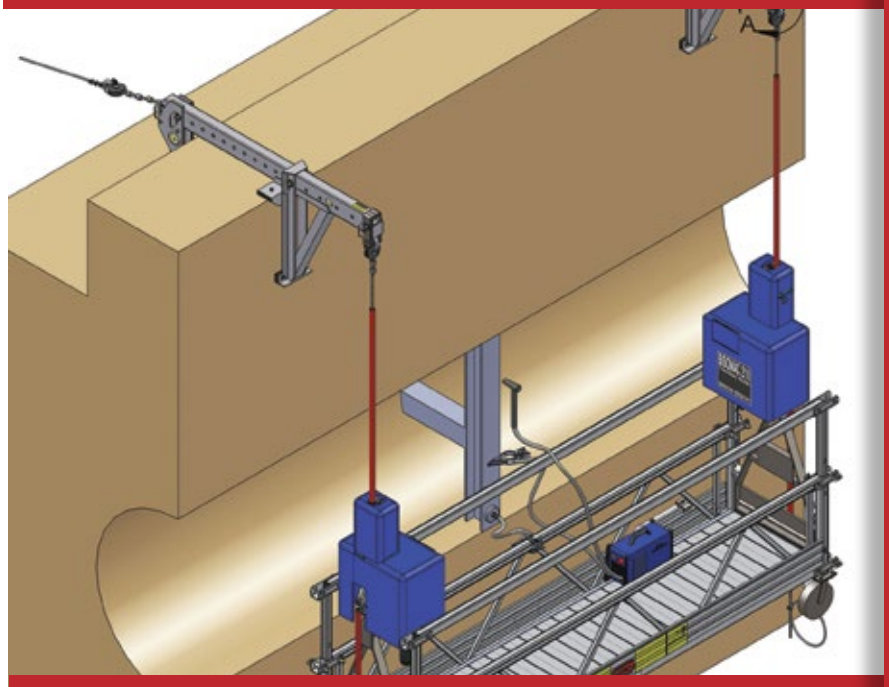
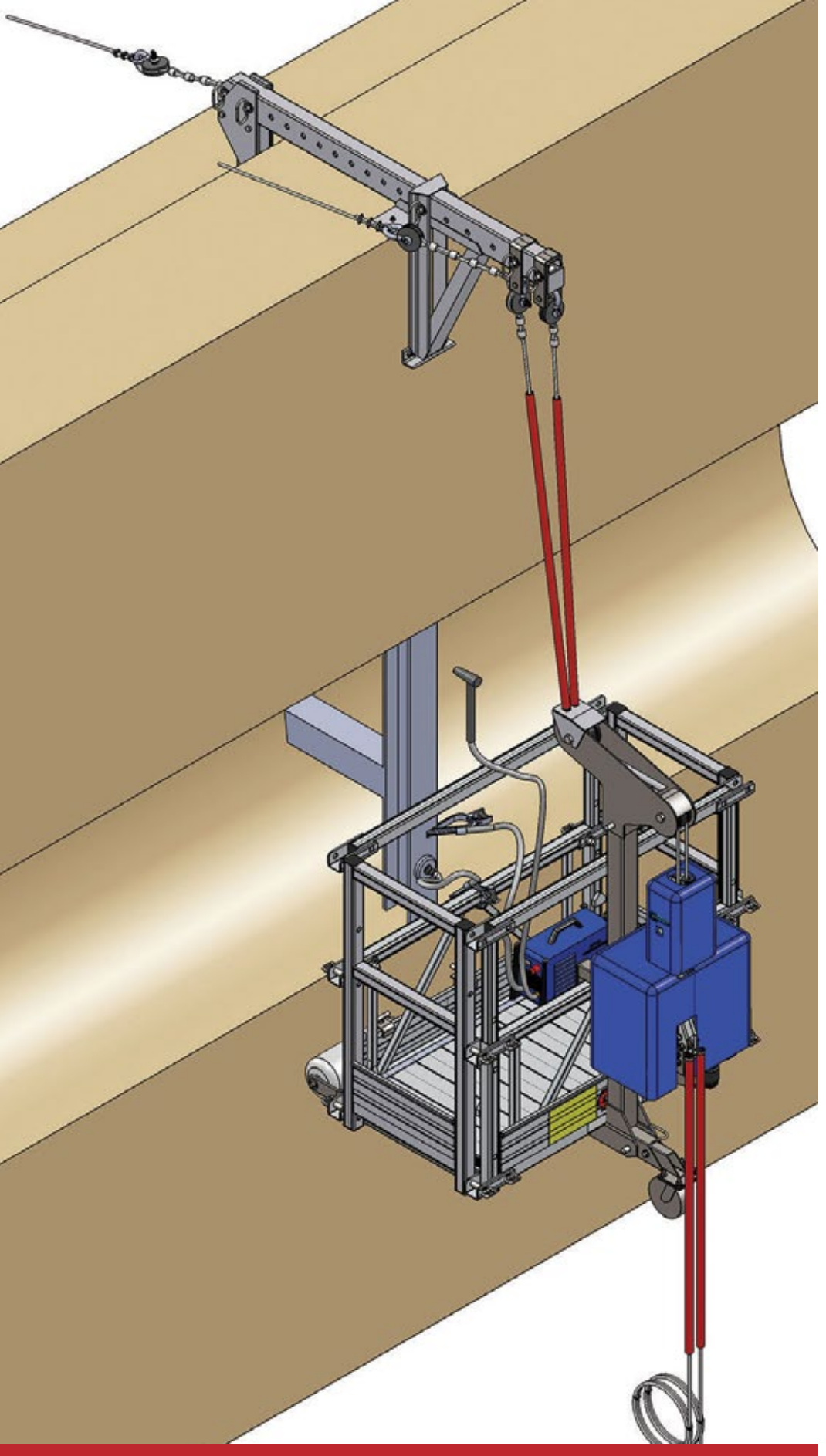


Illustration 7



See Illustration 8, second rope system

platform to another part of the equipment. If the scaffold were not grounded, that area of the platform could become energized and pose an electrocution hazard to an employee standing in that area.

The electrical potential created by connecting the grounding conductor to the structure conducts any fault current that might be created when welding from suspended scaffold platforms away from the employees. Grounding the scaffold limits the voltage on the scaffold frame, supplementing the protection provided by insulating the cables. Grounding the scaffold therefore provides additional shock protection for employees welding from the scaffold.

You also assert that if another welder is working 100 or so feet above the scaffold, and accidentally comes in contact with the cable suspending the scaffold, there could be an arc to the cable if the scaffold is grounded. Such an arc, you suggest, could sever the suspension cable.

We disagree with your conclusion. The presence of another potential source of arcing to a cable does not justify eliminating the safety feature of grounding the scaffold. Instead, it requires the employer to take other steps to protect against that hazard. If welding was being performed on adjacent scaffolds, the employer would be required to provide additional insulation on the suspension cable or provide other means for protecting it from contact by the other welders."

The following is what a final system looks like when using traction hoists and parapet clamp. Of course, a variety of rigging

options are available depending on the application. Note the use of roller bumpers with insulating properties to make sure any fault current goes through the grounding conductor. When using drum hoists, consult with the manufacturer for instructions.

By intentionally grounding the platform, OSHA essentially chooses to protect the worker against electrocution should a fault current be created. That means that the danger of a welding rod accidentally cutting the suspension rope still exists should the rope insulation be defective or someone is welding overhead. Although not required by law, it is highly recommended to add an auxiliary wire rope for extra safety. Adding the second wire rope will prevent the platform from going vertical, or the work cage from falling in the event of a suspension wire rope failure. Illustration 8 shows a work cage with the additional second rope safety.

See Illustration 8, second rope system

Be sure to add a second tieback cable directly fastened to the second rope, as well as insulated thimbles.

See Illustration 9, second wire rope thimbles

OSHA and ANSI have specific standards when adding a second wire rope. They can be found in ANSI A10.8, paragraph 6.6 and OSHA 1910.451, paragraph (g)(3). Consult your supplier on how to apply these standards to your specific application. •

About the Author
Tom Dejong is the Vice President of Bee Access Products.

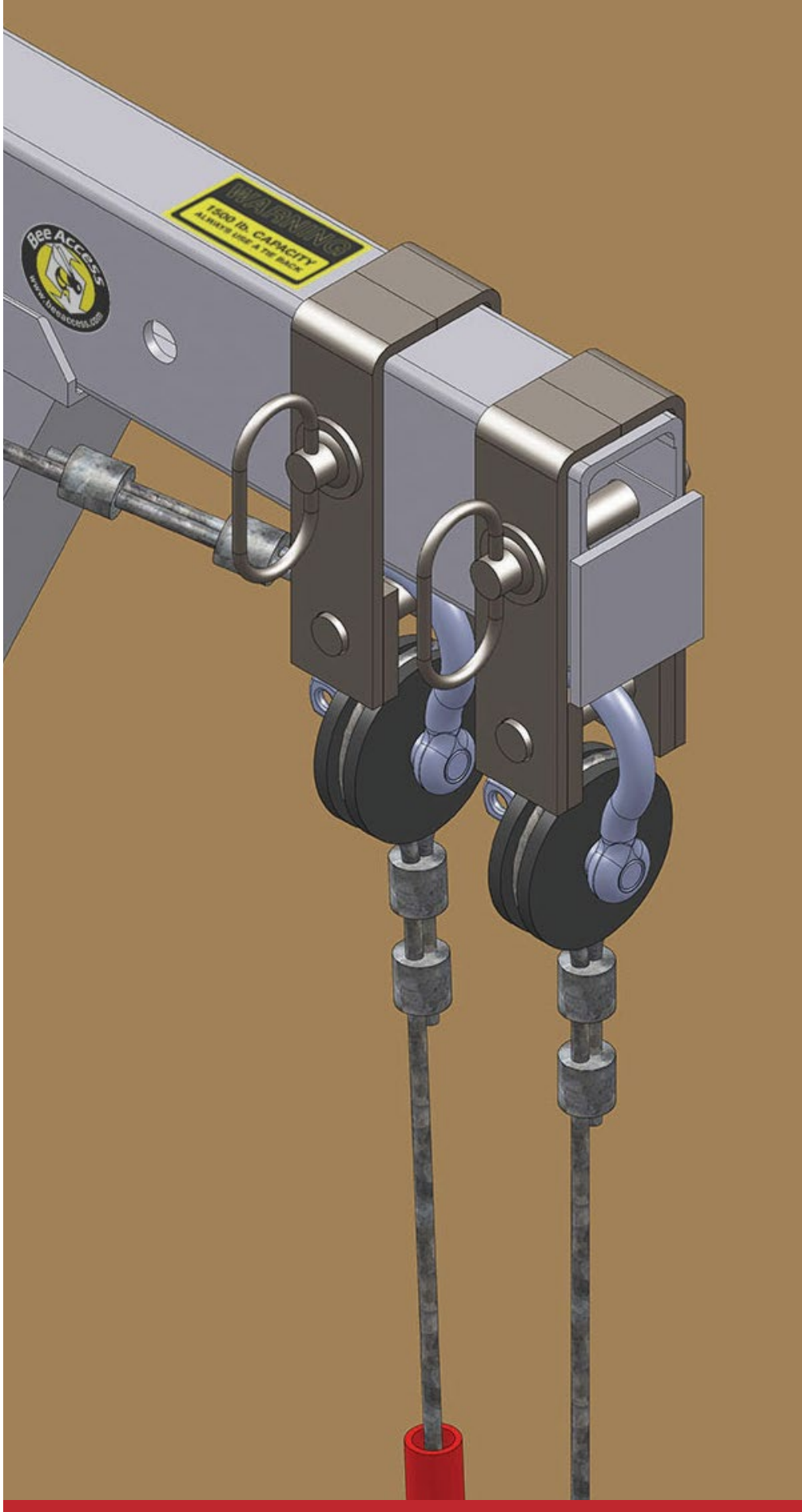
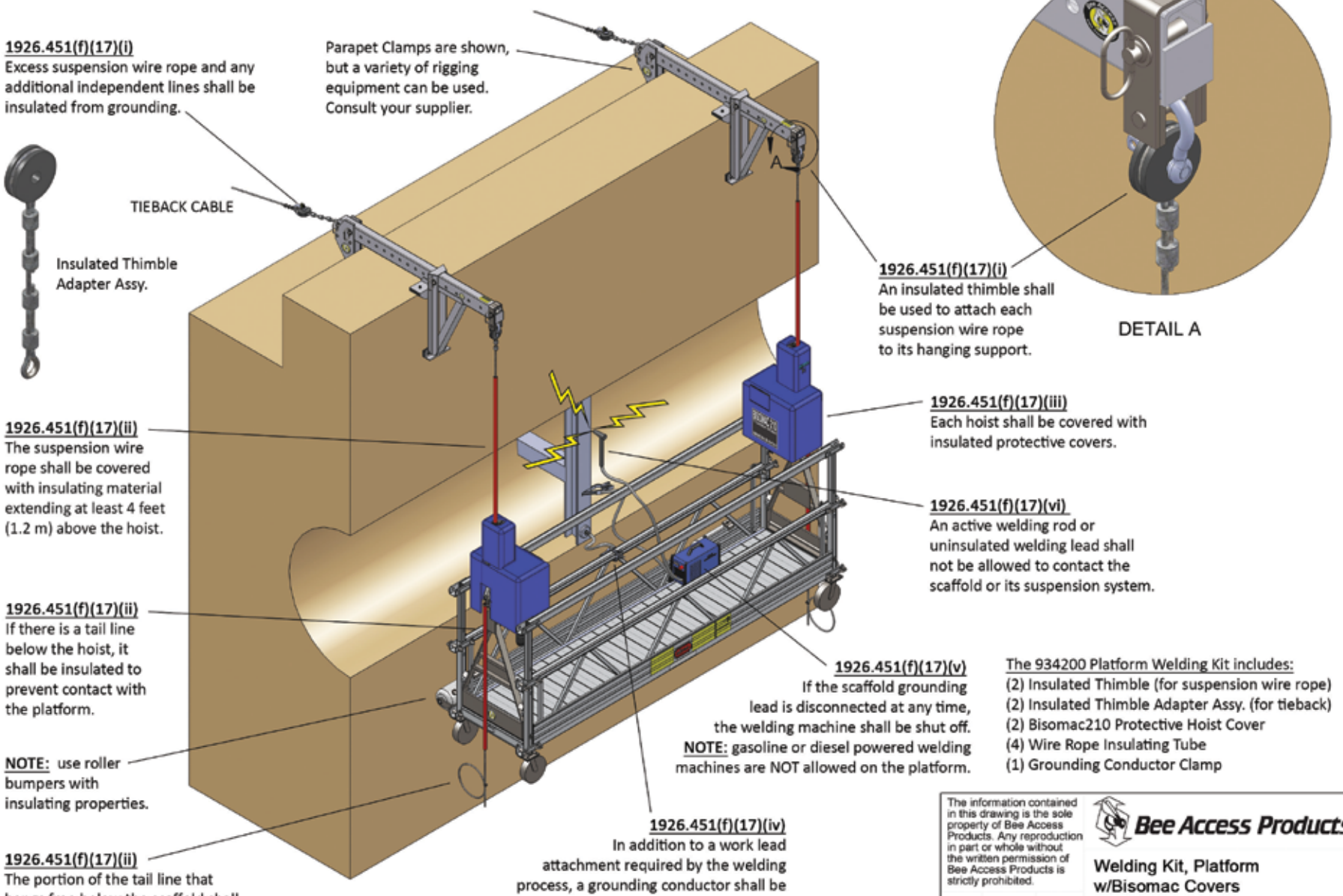


Illustration 9, second wire rope thimbles

WHEN WELDING FROM SUSPENDED SCAFFOLDS, READ, UNDERSTAND AND COMPLY WITH OSHA STANDARD 1926.451(f)(17)



The 934200 Platform Welding Kit includes:

- (2) Insulated Thimble (for suspension wire rope)
- (2) Insulated Thimble Adapter Assy. (for tieback)
- (2) Bisomac210 Protective Hoist Cover
- (4) Wire Rope Insulating Tube
- (1) Grounding Conductor Clamp

Bee Access Products

Welding Kit, Platform w/Bisomac Covers

Scale	Do not scale drawing.	Weight:
Approvals	By:	Date:
Drawn	SBS	02-23-15

Product Line/Project: Platform

REV. 1

Part No. 934200

Sheet