Work Distance Table (Control Zones)

NFPA 70E Table 130.4(C)(a) & (b)

Alternating Current

Training Requirements	**Qualified level** training required		**Authorized** Personnel ONLY **With Appropriate PPE**	
	Limited Approach Boundary		**Restricted Approach Boundary**	**Prohibited Approach Boundary**
Nominal System Voltage Range Phase-to-Phase	Exposed Movable Conductor(s) (Overhead lines)	Exposed Fixed Circuit Part(s) (MCC, Switchgear)	↓	↓
Less than 50 V	Not specified	Not specified	Not specified	Not specified
50 V to 300 V	10'-0"	3'-6"	Avoid contact	Avoid contact
301 V to 750 V	10'-0"	3'-6"	1'-0"	0'-1"
751 V to 15 kV	10'-0"	5'-0"	2'-2"	0'-7"
15.1 kV to 36 kV	10'-0"	6'-0"	2'-7"	0'-10"
36.1 kV to 46 kV	10'-0"	8'-0"	2'-9"	1'-5"
46.1 kV to 72.5 kV	10'-0"	8'-0"	3'-2	2'-1"

Clearances required by OSHA for construction projects may be greater than stated above, as per 29 CArc Rated 1926.416.

Direct Current

Training Requirements	**Qualified level** training required		**Authorized** Personnel ONLY **With Appropriate PPE**	
	Limited Approach Boundary		**Restricted Approach Boundary**	**Prohibited Approach Boundary**
Nominal Potential Difference	Exposed Movable Conductor(s) (Overhead lines)	Exposed Fixed Circuit Part(s) (MCC, Switchgear)	↓	↓
Less than 100 V	Not specified	Not specified	Not specified	Not specified
100 V to 300 V	10'-0"	3'-6"	Avoid contact	Avoid contact
301 V to 1 kV	10'-0"	3'-6"	1'-0"	0'-1"
1.1 kV to 5 kV	10'-0"	5'-0"	1'-5"	0'-4"
5 kV to 15 kV	10'-0"	5'-0"	2'-2"	0'-7"
15.1 kV to 45 kV	10'-0"	8'-0"	2'-9"	1'-5"
45.1 kV to 75 kV	10'-0"	8'-0"	3'-2	2'-1"

Clearances required by OSHA for construction projects may be greater than stated above, as per 29 CArc Rated 1926.416.

→ ***Keep all mechanical equipment a minimum of 10 feet away from overhead power lines. If voltage exceeds 50,000 volts, the clearance should be increased by 4 inches for each 10,000 volts.***

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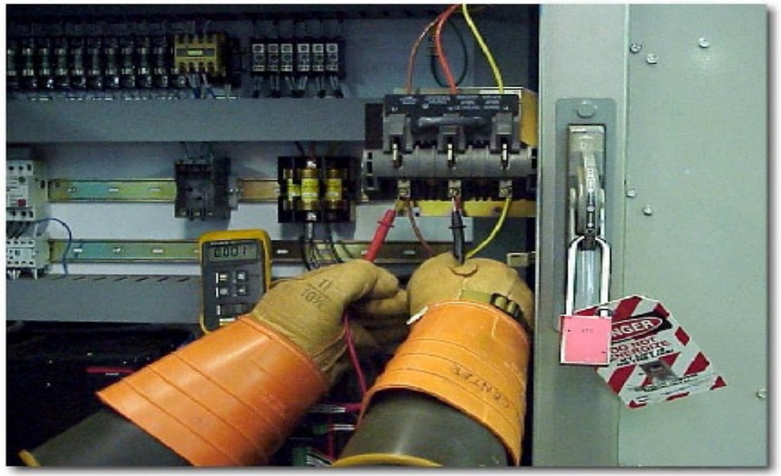
Arc-Flash Exposure Control



Qualified Person – *shall be trained and knowledgeable of the construction and operation of equipment or a specific work method and trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method.*

Authorized Person *– In the context of this guide, an authorized person is not only Qualified, but has been assigned to work on the equipment by Meiners Electric. Only Qualified personnel that have been authorized, may work within the Restricted or Prohibited Approach Boundary.*

Limited – *A safe approach boundary. Only qualified employees and escorted unqualified employees may cross*

Restricted – *Only qualified, authorized employees may cross. When working within this boundary, must use special precautionary techniques and PPE*

Prohibited – *Only qualified, authorized employees protected by insulating materials*

NOTE: *Reasonable care has been taken in preparing this document and the information provided herein is believed to be accurate. However, this information is not intended to constitute an "authoritative resource"*

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Minimum PPE Requirements

It is the policy of Meiners Electric that whenever employees are exposed to, or working with live electrical voltages greater than 50 volts, the following minimum Personal Protective Equipment (PPE) shall be used along with the appropriate Personal Protective Equipment (PPE) for the HRC level for the work being performed.

1. Hardhat
2. Safety Glasses
3. Heavy duty leather gloves
4. Appropriate rubber goods for task
5. Long sleeve shirt and pants
6. Leather work boots
7. Hearing Protection (ear canal inserts)

Hazard Risk Categories (HRC Level)

Hazard / Risk category	Clothing description	Minimum required arch flash rating of PPE.
0	Non-melting or untreated natural fiber such as untreated cotton or wool, rayon, or silk, or blends of these materials with a fabric weight of at least 4.5oz/yd.	**N/A**
1	Arc Rated shirt and Arc Rated pants or Arc Rated coveralls with an arc rating of at least 4 cal/cm^2	**4 Cal**
2	Arc Rated shirt and Arc Rated pants or Arc Rated coveralls with an arc rating of at least 8 cal/cm^2, arc rated hood or balaclava with arc rated visor or goggles	**8 Cal**
3	Arc Rated flash suit and hood with an arc rating of at least 25 cal/cm^2	**25 Cal**
4	Arc Rated flash suit and hood with an arc rating of at least 40 cal/cm^2	**40 Cal**
Greater Than 4	Hazard/Risk Categories greater than 4 are considered prohibited due to the sound, pressure and concussive forces present. Above this level these forces are more significant than the thermal values. **No work** is to be done above Category 4 without a full evaluation by person(s) qualified at these hazard levels.	**N/A**

Selection and Proper Wear of PPE

These PPE requirements are intended to protect a person from arc flash and electric shock. While some situations could result in burns to the skin even while complying to the above requirements, burn injury should be reduced and survivable.

1. Use NFPA 70E table 130.7 to determine the Hazard/Risk Category (HRC) for the work that is to be performed. **Note:** If the equipment to be worked on is labeled with a higher HRC requirement than table 130.7, the higher HRC requirement will be followed.

2. Inspect all PPE for damage before use – Do Not use damaged PPE.

3. Inspect all rubber goods for damage and dielectric testing dates – Do not use rubber goods if the date is over 90 days from testing.

4. When donning arc protection at HRC levels of 2 and above, no skin should be exposed, use the buddy check method before entering the arc boundary.

Controlling The Work Area

Barricades

Barricades shall be used to cordon off our work area(s) when live electrical work is to be performed or a panel cover/door is to be opened exposing live circuits 50 volts or greater. The barricade shall consist (at a minimum) of red danger tape positioned at least 10 feet from the exposure (when possible) and appropriately marked with the type of hazard posed along with the contact number of the person in charge.

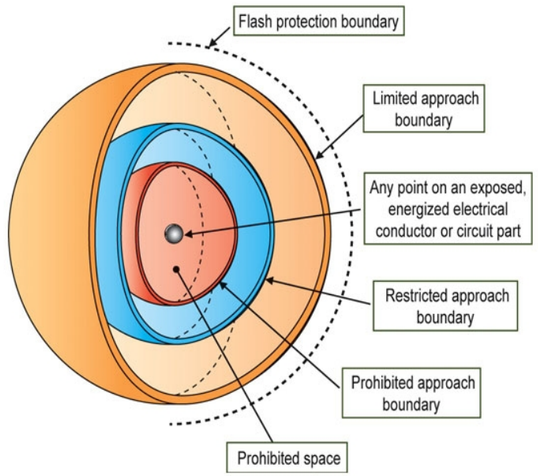
Controlling Access

Access to our work area(s) are to be strictly controlled. Only qualified personnel that our authorized by the person in charge shall be allowed within the barricaded area.

Unqualified authorized personnel may enter the barricaded area, but must be escorted and they shall not enter the limited approach boundary, ***unless:***

There is a need for an unqualified person(s) to cross the limited approach boundary, a qualified person shall advise them of the possible hazards and continuously escort the unqualified person(s) while inside the limited approach boundary. Under no circumstances shall the unqualified person(s) be permitted to cross the restricted approach boundary.

Refer to NFPA 70E Table 130.4(C)(a) and (b) to determine the limited and restricted approach boundaries.



Securing the Area

In the event that the work area must be left unattended, all exposed conductors shall be rendered safe in accordance with OSHA standard 1910.303.

NFPA 70E 2012 (Direct Current)

TASK PERFORMED ON ENERGIZED EQUIPMENT	*HRC*	*Rubber Gloves*	*Insulated Tools*
Storage batteries, direct-current switchboards and other direct-current supply sources >100 V <250V **Parameters**: Voltage: 250 V, Maximum arc duration and working distance: 2 sec @ 18 in.			
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ~ 1 kA and <4 kA Potential arc flash boundary using above parameters at 4 kA: 36 in.	**1**	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ~4 kA and <7 kA Potential arc flash boundary using above parameters at 7 kA: 48 in.	**2**	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ~7 kA and <15 kA Potential arc flash boundary using above parameters at 15 kA: 72 in.	**3**	Y	Y
Storage batteries, direct-current switchboards and other direct-current supply sources ~250 V ~600V **Parameters:** Voltage: 600 V, Maximum arc duration and working distance: 2 sec @ 18 in.			
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ~1 kA and <1.5 kA Potential arc flash boundary using above parameters at 1.5 kA:, 36 in.	**1**	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ~1.5 kA and <3 kA Potential arc flash boundary using above parameters at 3 kA: 48 in.	**2**	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ~3 kA and <7 kA Potential arc flash boundary using above parameters at 7 kA: 72 in.	**3**	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ~7 kA and <10 kA Potential arc flash boundary using above parameters at 10 kA: 96 in.	**4**	Y	Y

NFPA 70E 2012 (Alternating Current)

TASK PERFORMED ON ENERGIZED EQUIPMENT	*HRC*	*Rubber Gloves*	*Insulated Tools*
Panelboards or other equipment rated 240 V and below **Parameters:** Maximum of 25 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 19 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	**0**	N	N
Circuit breaker (CB) or fused switch operation with covers on	**0**	N	N
CB or fused switch operation with covers off	**0**	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	**1**	Y	Y
Remove/install CBs or fused switches	**1**	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts	**1**	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	**0**	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of-the panelboard	**1**	Y	Y
Panelboards or other equipment rated > 240 V and up to 600 V **Parameters:** Maximum of 25 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using .above parameters: 30 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	**1**	N	N
Circuit breaker (CB) or fused switch operation with covers on	**0**	N	N
CB or fused switch operation with covers off	**1**	Y	N
Work on energized electrical conductors and circuit parts, including voltage testing	**2**	Y	Y
Remove/install CBs or fused switches	**2**	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	**1**	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	**0**	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	**2**	Y	Y
600 V class motor control centers (MCCs) **Parameters:** Maximum of 65 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 53 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	**1**	N	N
CB or fused switch or starter operation with enclosure doors closed	**0**	N	N
Reading a panel meter while operating a meter switch	**0**	N	N
CB or fused switch or starter operation with enclosure doors open	**1**	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	**2**	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	**0**	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	**2**	Y	Y
Application of temporary protective grounding equipment, after voltage test	**2**	Y	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the motor control center	**2**	Y	Y
600 V class motor control centers (MCCs) **Parameters:** Maximum of 42 kA short circuit current available; maximum of 0.33 sec (20 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 165 in.			

***600 V class motor control centers (MCCs) -* Continued**			
Insertion or removal of individual starter "buckets" from MCC	**4**	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	**4**	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	**1**	N	N
600 V class switchgear (with power circuit breakers or fused switches) and 600 V class switchboards **Parameters:** Maximum of 35 kA short circuit current available; maximum of up to 0.5 sec (30 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 233 IN.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	**2**	N	N
CB or fused switch operation with enclosure doors closed	**0**	N	N
Reading a panel meter while operating a meter switch	**0**	N	N
CB or fused switch operation with enclosure doors open	**1**	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	**2**	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	**0**	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	**2**	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open or closed	**4**	N	N
Application of temporary protective grounding equipment after voltage test	**2**	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	**4**	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	**2**	N	N
Other 600 V class (277 V through 600 V, nominal) equipment **Parameters**: Maximum of 65 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance (except as indicated) Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 53 in.			
Lighting or small power transformers (600 V, maximum)			
* Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	**2**	N	N
* Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	**1**	N	N
* Work on energized electrical conductors and circuit parts, including voltage testing	**2**	Y	Y
* Application of temporary protective grounding equipment, after voltage test	**2**	Y	N
Revenue meters (kW-hour, at primary voltage and current)-insertion or removal	**2**	Y	N
Cable trough or tray cover removal or installation	**1**	N	N
Miscellaneous equipment cover removal or installation	**1**	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	**2**	Y	Y
Application of temporary protective grounding equipment, after voltage test	**2**	Y	N
Insertion or removal of plug-in devices into or from busways	**2**	Y	N
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV Parameters: Maximum of 35 kA short circuit current available; maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 422 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	**3**	N	N
Contactor operation with enclosure doors closed	**0**	N	N
Reading a panel meter while operating a meter switch	**0**	N	N
Contactor operation with enclosure doors open	**2**	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	**4**	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	**0**	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V exposed	**3**	Y	Y
Insertion or removal (racking) of starters from cubicles, doors open or or closed	**4**	N	N
Application of temporary protective grounding equipment, after voltage test	**3**	Y	N

***NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV* - Continued**			
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	**4**	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	**3**	N	N
Insertion or removal (racking) of starters from cubicles of arc-resistant construction, tested in accordance with IEEE C37.20.7, doors closed only	**0**	N	N
Metal clad switchgear, 1 kV through 38 kV **Parameters:** Maximum of 35 kA short circuit current available; maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 422 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	**3**	N	N
CB operation with enclosure doors closed	**2**	N	N
Reading a panel meter while operating a meter switch	**0**	N	N
CB operation with enclosure doors open	**4**	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	**4**	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	**2**	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	**4**	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open or closed	**4**	N	N
Application of temporary protective grounding equipment, after voltage test	**4**	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	**4**	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	**3**	N	N
Opening voltage transformer or control power transformer compartments	**4**	N	N
Arc-resistant switchgear Type 1 or 2 (for clearing times of < 0.5 sec with a perspective fault current not to exceed the arc-resistant rating of the equipment) **Parameters**: Maximum of 35 kA short circuit current available; maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 422 in.			
CB operation with enclosure door closed	**0**	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	**0**	N	N
Insertion or removal of CBs from cubicles with door open	**4**	N	N
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	**2**	Y	Y
Insertion or removal (racking) of ground and test device with door closed	**0**	N	N
Insertion or removal (racking) of voltage transformers on or off the bus door closed	**0**	N	N
Other equipment 1 kV through 38 kV **Parameters**: Maximum of 35 kA short circuit current available; maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 422 in.			
Metal-enclosed interrupter switchgear, fused or unfused			
* Switch operation of arc-resistant-type construction, tested in accordance with IEEE C37.20.7, doors closed only .	**0**	N	N
* Switch operation, doors closed	**2**	N	N
* Work on energized electrical conductors and circuit parts, including voltage testing	**4**	Y	Y
* Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	**4**	N	N
* Opening hinged covers. (to expose bare, energized electrical conductors and circuit parts)	**3**	N	N
Outdoor disconnect switch operation (hookstick operated)	**3**	Y	Y
Outdoor disconnect switch operation (gang-operated, from grade)	**2**	Y	N
Insulated cable examination, in manhole or other confined space	**4**	Y	N
Insulated cable examination, in open area	**2**	Y	N