ELECTRICAL SAFETY GUIDE

HELPING EMPLOYERS

***PROTECT WORKERS** from*

Arc Flash and other Electrical Hazards

meltric.com

MELTRIC
A COMPANY OF MARECHAL ELECTRIC

WHY AN EFFECTIVE SAFETY PROGRAM IS ESSENTIAL

The Hazards are Real

Electrical Shocks

National Safety Council statistics show that electrical injuries still occur in U.S. industries with alarming frequency:

- 30,000 non-fatal electrical shock accidents occur each year
- 1,000 fatalities due to electrocution occur each year

Recent studies also indicate that more than half of all fatal electrocutions occurred during routine construction, maintenance, cleaning, inspection, or painting activities at industrial facilities.

Although electrical shock accidents are frequent and electrocutions are the fourth leading cause of industrial fatalities, few are aware of how little current is actually required to cause severe injury or death. In this regard, even the current required to light just a 7 1/2 watt, 120 volt lamp is enough to cause a fatality – if it passes across a person's chest.

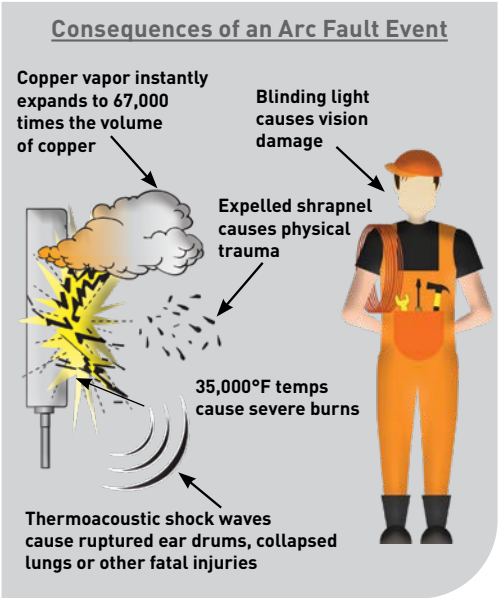
Arc Flash and Arc Blasts

The arc flash and arc blasts that occur when short circuit currents flow through the air are violent and deadly events.

- Temperatures shoot up dramatically, reaching up to 35,000° Fahrenheit and instantly vaporizing surrounding components.
- Ionized gases, molten metal from vaporized conductors and shrapnel from damaged equipment explode through the air under enormous pressure.

Anyone or anything in the path of an arc flash or arc blast is likely to be severely injured or damaged.

Statistics from the National Institute for Occupational Safety and Health indicate that five to ten arc flash explosions occur in electrical equipment every day in the United States; these accidents send more than 2,000 workers to burn centers with severe injuries each year.[2]



2 Capschell, Inc.

It's Your Responsibility and It's the Law

As an official act of Congress, the Occupational Safety and Health Act of 1970 is the law. Section 5(a) mandates that each employer shall:

1. Furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious harm to his employees.
2. Comply with occupational safety and health standards promulgated under the act.

One of the key OSHA regulations that employers must comply with is 29 CFR 1910 'Occupational Safety & Health Standards.' These standards establish the legal obligation requiring employers to proactively assess workplace hazards and take appropriate actions to advise and protect their employees from the hazards.

In situations where electrical injury has occurred, OSHA uses compliance with **NFPA 70E** as a key test in determining whether or not appropriate precautions have been taken. If they have not been, the employer may be subject to substantial fines and management personnel may be held criminally liable.

29 CFR 1910 – Occupational Safety & Health Standards

Key Electrical Safety Requirements

General requirements. – 1910.132

1910.132(d)(1) The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, the employer shall:

1910.132(d)(1)(i)–(iii) Select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazards identified in the hazard assessment; Communicate selection decisions to each affected employee; and, Select PPE that properly fits each affected employee.

1910.132(f)(1)(i) The employer shall provide training to each employee who is required by this section to use PPE.

Safeguards for personnel protection. – 1910.335

1910.335(a)(1)(i) Employees working in areas where there are potential electrical hazards shall be provided with, and shall use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed.

The Costs of Electrical Accidents can be Enormous

Injury Costs

When serious electrical accidents occur, the cost to a business often exceeds $1 million, and the cost to the injured person is immeasurable.

OSHA Citations

On average, OSHA issues 40,000 safety citations per year. Penalties for serious violations may be tens or even hundreds of thousands of dollars, depending upon the situation.

Lawsuits

In addition to the financial impacts of legal and settlement costs, the lost time and productivity disruptions caused by personal injury lawsuits can be a significant burden.

NFPA 70E®

Visit *NFPA.org* to purchase a complete copy of the NFPA 70E Standard

National Electric Code Section 110.16 Arc Flash Hazard Warning
FPN No. 1:

NFPA 70E-2021, Standard for Electrical Safety in the Workplace, provides guidance; such as, determining the severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

NFPA 70E is a registered trademark of the National Fire Protection Association, Quincy, MA 02169

As the standard for electrical safety in the workplace, NFPA 70E addresses the safety-related work practices, maintenance requirements, and administrative controls necessary to protect employees from electrical energy hazards. It serves several important purposes:

- It is the primary resource and guide for employers to use in determining how to comply with OSHA's electrical safety regulations.
- It is also used by OSHA and the courts in workplace injury investigations to assess whether or not the involved employers took reasonable and appropriate precautions to protect their employees.

Failure to comply with NFPA 70E may prove very expensive if injury occurs.

Key Elements of the Standard

The NFPA 70E standard was developed in the U.S., but has been largely adopted in Canada's CSA Z462 'Workplace Electrical Safety' standard and is also increasingly recognized and used in Mexico, so the key elements summarized below will generally apply in all three countries. Consult the standards for complete details.

Article 110 – General Requirements for Electrical Safety-Related Work Practices

Electrical Safety Program

The OSHA CFR 1910.333 Standard is quite clear about employer's responsibilities: Section (a) states that "Safety-related work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energized."

Article 110 of the NFPA70E standard provides helpful guidance on how these and other associated legal requirements in the OSHA Standard can be met.

The Standard for Electrical Safety in the Workplace

First Priority: Hazard Elimination

Hazard elimination is specifically identified as the first priority in the implementation of safety-related work practices, and accordingly is the first method listed in the Hierarchy of Risk Control Methods to be employed:

(1) Elimination (2) Substitution (3) Engineering Controls (4) Awareness (5) Administrative Controls (6) PPE

It is important to note that the use of PPE is indicated as the least effective risk control method. If a hazard can be eliminated, it should be eliminated; there is no risk of injury if hazards do not exist.

Electrically Safe Work Condition

The OSHA CFR 1910.333 Standard also requires, in section (a)(1), that "Live parts (above 50V) to which an employee may be exposed shall be deenergized before the employee works on or near them, unless the employer can demonstrate that deenergizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations."

Thus, an employer's Electrical Safety-Related Work Practices must include the determination of when it is necessary to establish an **Electrically Safe Work Condition** by disconnecting and isolating the circuit parts to be worked on from the energized circuit.

Energized electrical conductors and circuit parts operating at 50V or more, are required to be placed into an electrically safe work condition before work can begin, if:

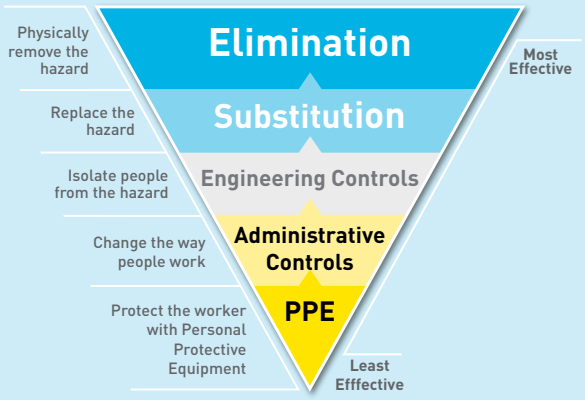
1. The activity is not a permitted normal operation of energized equipment
2. The employee is within the limited approach boundary
3. There is an increased likelihood of injury from an exposure to arc flash hazards

Normal Operation

Normal operation of energized electric equipment shall be permitted provided the equipment is properly installed and maintained with no evidence of impending failure; and is being used for its intended function in accordance with the manufacturer's instructions, labeling and listings, and with any doors or covers closed and secured. Normal operation refers to using the equipment, not working on it.

NFPA 70E Standard for Electrical Safety in the Workplace

HIERARCHY OF RISK CONTROL METHODS



National Institute for Occupational Safety and Health (NIOSH)

NFPA 70E®

CSA Z462
Workplace Electrical Safety

CSA Z462 is a Workplace Electrical Safety standard in Canada. It is based on NFPA 70E and has been harmonized with Parts I, II and III of the Canadian Electrical Code.

Visit *csagroup.org/store* to purchase a complete copy of CSA Z462.

Justification for Energized Work

Deciding to work on or near energized electrical conductors and circuit parts should be a last resort in the workplace, after all opportunities for establishing an electrically safe work condition have been exhausted. Work on energized parts at 50V or more should only be performed if the employer can demonstrate that deenergizing will introduce additional hazards, or is not feasible due to equipment design or operational limitations.

Electrical Safety Program

Another key work practice requirement is the maintenance of a documented electrical safety program to direct employee activities in a manner appropriate for the different voltage, energy level, and circuit conditions that may be encountered. The program must address inspections, maintenance, employee awareness and self-discipline, electrical safety principles and procedures, risk assessment and control, job planning, communication, and scope changes, incident investigations, electrically safe work condition policy, lockout/tagout, audits, and documentation.

Training Requirements

Employees who may be exposed to electrical hazards must be specifically trained to understand the hazards associated with electrical energy, as well as the safety-related work practices and procedures required to provide protection from them. The level of training an employee receives determines the tasks he/she is qualified to perform.

Only **'Qualified Persons'** with appropriate qualifications may perform work on or near exposed and energized electrical conductors or circuit parts. The training requirements include:

- Recognizing and assessing potential hazards and risk control methods
- Distinguishing energized from non-energized parts and determining the voltage
- Understanding the relationship between the hazard and potential injury
- Determining approach and flash protection boundaries
- Selecting appropriate personal protective equipment and tools
- Specific work practices and procedures to be followed
- Lockout/tagout procedures
- Emergency procedures for assisting victims of electrical incidents

The Standard for Electrical Safety in the Workplace

Article 120 – Establishing an Electrically Safe Work Condition

The most effective way to prevent electrical injury is to eliminate the hazards by establishing an electrically safe work condition. To do so, workers must identify and disconnect all possible sources of electrical energy and prevent its reappearance through effective lockout/tagout procedures.

This article of the standard focuses heavily on lockout-tagout principles, equipment, and procedures. It defines the following eight-step procedure for establishing and verifying an electrically safe work condition.

Procedure to Establish an Electrically Safe Work Condition

1. **Identify and locate all possible sources of electric supply. Check applicable up-to-date drawings, diagrams, and identification tags.** Care should be taken to identify possible secondary sources.
2. **Properly interrupt the load current(s) and open the disconnecting device(s).** Not all disconnecting devices are rated to interrupt load currents; this should only be done with a properly rated device.
3. **Verify deenergization through visual inspection of the disconnect contacts.** Disconnecting means may sometimes fail to open all phase conductors when the handle is operated, so it is necessary to verify physical contact separation. If this requires removing the disconnect door or cover, appropriate PPE must be used.
4. Release stored electrical energy.
5. Release or block stored mechanical energy.
6. **Apply lockout/tagout devices.** This should be done in accordance with a formally-established company policy.
7. **Use an adequately rated portable test instrument to test each phase conductor or circuit part to which the worker may be exposed in order to verify deenergization.** The voltage detecting device must be functionally tested both before and after taking the measurements, in order to ensure that it is working satisfactorily.
8. **Circuit parts with induced voltages or stored electrical energy must be grounded.** If the conductors being deenergized could contact other energized conductors or circuit parts, temporary grounding devices rated for the available fault duty should be applied.

Lockout/tagout is quick and easy since all MELTRIC Switch-Rated devices have integral locking provisions.

- A user simply needs to provide a lock to perform lockout/tagout on MELTRIC plugs.
- Simple lockout provisions are also available on MELTRIC receptacles.
- Easily lock the plug and receptacle together to prevent unauthorized disconnection.

NFPA 70E®

Connection and disconnection of a MELTRIC Switch-Rated plug and receptacle is a NFPA 70E defined 'Normal Operation.'

Arc Flash PPE Required: No

NFPA 70E – Section 130.2 Electrically Safe Working Conditions
(A) Energized Work
4) Normal Operation
Normal operation of electric equipment shall be permitted where the equipment; is properly installed and maintained; used in accordance with manufacturer's instructions; doors are closed and secured; covers are in place and secured; there is no evidence of impending failures.

Article 130 – Work Involving Electrical Hazards

When electrical conductors and circuits over 50 volts cannot be placed into an electrically safe work condition, and work is performed as permitted in accordance with NFPA 70E Section 110.4, the following requirements must be met:

- Only qualified persons are permitted to work on electrical conductors or circuits that have not been placed in an electrically safe work condition.
- A required energized electrical work permit shall be completed.
- Required shock and arc flash risk assessments shall be performed.

Work Permit

When non-routine work must be performed on energized parts or within the restricted approach boundary, a detailed work permit must be prepared before the work can begin. The work permit must document the following elements and be approved/signed by a responsible owner, manager, or safety officer:

- The location and description of the circuit and equipment to be worked on
- A description of the work to be performed
- Justification for performing the work in an energized condition
- A description of the safe work practices to be employed
- Results of the shock risk assessment
- Determination of shock protection boundaries
- Results of the arc flash risk assessment
- Determination of the flash protection boundary
- The personal protective equipment required for worker safety
- Restricted access of unqualified persons from the work area
- Evidence that the job briefing has been completed

The Standard for Electrical Safety in the Workplace

Shock Risk Assessment and Approach Boundaries

A shock risk assessment shall be performed to identify shock hazards, estimate the likelihood and severity of injury or damage, and determine the associated required protective measures, including PPE. Because personnel will approach energized electrical conductors or other live circuit parts, limited and restricted approach boundaries must be determined in order to identify safe approach distances and the precautions required to minimize the possibility of shock. These boundaries are determined by consulting tables in the standard based on voltage and conductor type.

Arc Flash Risk Assessment

An arc flash risk assessment shall also be performed by a qualified person to identify arc flash hazards, estimate the likelihood and severity of injury or damage, and to determine if additional protective measures, including PPE, are required. As a part of this assessment, flash protection boundaries must be determined based on the incident energy, and will be the distance at which the incident energy equals 1.2 cal/CM². The distances for common equipment and voltage levels are provided by table in the standard. Others must be determined by specific calculation.

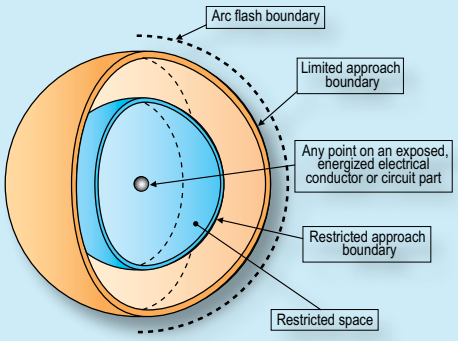
Personal and Other Protective Equipment

Employees working in areas where electrical hazards are present must be qualified to perform the work. They must be provided with, and use, protective equipment designed and constructed for the specific part of the body to be protected and for the work to be performed. Personal Protective Equipment (PPE) requirements can be determined from tables in the standard, based either on the calculated incident energy level, or on the PPE category assigned to the type and electrical energy characteristics of the equipment being worked on.

Section 130.7(C)(15) provides details on selection of appropriate arc rated PPE. Four categories of increasingly protective PPE are defined based on the minimum level of incident energy they provide protection against. The PPE category required can be determined by calculation of the incident energy level or by consulting the table identifying PPE categories for common equipment and voltage levels.

Limits of Approach

Before work can begin near exposed energized parts, approach and flash protection boundaries must be determined.



Flash protection boundary – distance from a prospective arc source within which a person could receive a second degree burn if an arc flash were to occur.

Limited approach boundary – distance within which a shock hazard exists.

Restricted approach boundary – distance within which there is an increased likelihood of shock, due to electrical arc-over combined with inadvertent movement.

NFPA 70E is a registered trademark of the National Fire Protection Association, Quincy, MA 02169

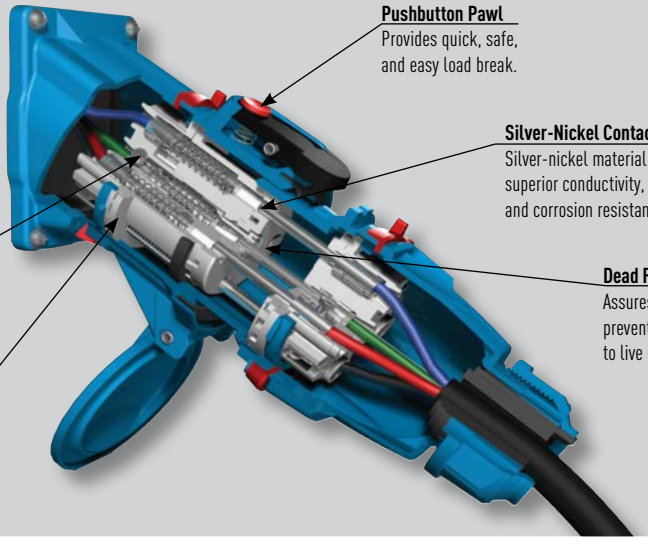
ENSURE SAFETY with MELTRIC's Switch-Rated Plugs and Receptacles featuring DECONTACTOR™ Technology

Provide the Safety of a Switch with Every Plug and Receptacle

MELTRIC's Switch-Rated plugs and receptacles combine the safety and functionality of a disconnect switch with the convenience of a plug and receptacle. They allow users to safely make and break connections under full load and provide significant protection in overload and short circuit conditions. They are UL and CSA rated for:

- Branch circuit disconnect switching, up to 200A
- Motor circuit disconnect switching, up to 100 hp
- Short circuit closing and withstand, up to 100kA in circuits protected with RK1 current limiting fuses

DECONTACTOR™ Technology



WORK SAFETY

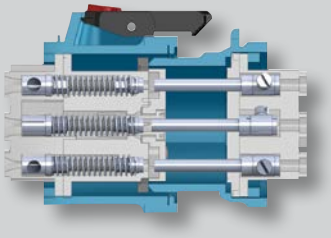
Prevent Unintended Exposure to Live Parts and Arcing

MELTRIC's Switch-Rated plugs and receptacles provide the safety and security of true dead front construction.

- Load making and breaking is isolated in enclosed arc chambers.
- A safety shutter automatically closes and blocks access to the live contacts before the plug can be removed.

These features ensure that the plug contacts are deenergized before the plug is removed and they prevent unintended access to live parts and exposure to arcing during product operation.

Dead Front



Enclosed Arc Chambers

Provide Consistently Reliable Connections

MELTRIC Switch-Rated plugs and receptacles use DECONTACTOR™ technology similar to motor starters.

- Spring-loaded butt-style contacts ensure that optimal contact force is always maintained.
- Solid silver-nickel contact material resists wear, withstands arcing and corrosion, and maintains superior electrical performance.
- Spring-driven operating mechanisms ensure a quick and positive load-break and eject the plug to the OFF position.

MELTRIC Switch-Rated plugs and receptacles allow welders and other equipment to be safely connected and disconnected, even in overload conditions.

ELIMINATE THE HAZARDS of Standard Plugs & Receptacles

Switch-Rated Plugs and Receptacle

Pressing the pawl on the switch-rated receptacle breaks the electrical connection. The deenergized plug can then be safely withdrawn.

MELTRIC DS and DSN series switch-rated plugs and receptacles are designed and rated to function as a switch. Users can safely make and break connections, even in overload conditions.

- Silver-nickel contacts resist wear and maintain superior conductivity even in wet and corrosive environments.
- Silver-nickel butt-style contacts withstand arcing and resist welding, allowing them to close into and withstand short circuit currents as high as 100kA.
- Enclosed arc chambers and dead front construction prevent exposure to arcing and eliminate unintended access to live parts.

Switch-rated plugs and receptacles from MELTRIC provide a secure and foolproof means of ensuring user safety without the need for interlocks and safety switches required with other types of plugs and receptacles. At no time is a user exposed to live contacts while connecting or disconnecting.

Standard Plugs & Receptacles

Most traditional plugs and receptacles should never be connected or disconnected under load.

Standard pin and sleeve and twist type plugs and receptacles are not intended to be disconnected or connected under load. Doing so can be very hazardous.

- The electrical properties of their brass contacts degrade significantly from oxidation and wear occuring with normal use.
- Because brass cannot withstand arcing, the contacts may vaporize and cause an arc flash if connected or disconnected in overload conditions.
- Live front designs expose users to live parts and also to the arcing or arc blasts that may result from their use in adverse conditions.

Because nothing prevents these devices from being connected and disconnected under load in many applications, users are often exposed to these hazards. When interlocks are provided, their function is often defeated by the use of extension cords.

SIMPLIFY NFPA 70E COMPLIANCE

with MELTRIC's Switch-Rated Plugs and Receptacles featuring DECONTACTOR™ Technology

MELTRIC's Switch-Rated plugs and receptacles simplify compliance with NFPA 70E by eliminating the possibility of exposure to energized parts and arcing when making and breaking the electrical connections required to changeout motors and other equipment. This avoids the need to take many of the special precautions required to ensure that workers are aware of and protected from the shock and arc-flash hazards that exist whenever work is performed on or around energized circuit components.


Integral provisions make lockout/tagout simple.

Switch Ratings Simplify Deenergization

With push button load-breaking, UL and CSA switch ratings for applications up to 200A and short circuit closing and withstand ratings up to 100kA (in circuits protected with RK1 current limiting fuses), switch-rated plugs and receptacles provide a safe, simple, and convenient means of disconnecting the load. There is no need for the interlocks and auxiliary disconnects required with standard plugs and receptacles.

Dead Front Construction Ensures a Safe Work Condition

DECONTACTOR™ technology ensures that load making and breaking is isolated in enclosed arc chambers and that a safety shutter closes over the live receptacle contacts before the plug can be removed. This prevents user exposure to live parts and arcing, and ensures that a safe work condition is maintained. There is no need to perform a hazard analysis, obtain work permits, use cumbersome PPE, or take the other precautions required when working on or near live parts.

Plug Removal Verifies Deenergization

Removing the plug from the receptacle provides visual verification of contact separation and deenergization. This avoids the need for the voltage testing required with many other disconnect switches that often involves energized electrical work and associated safety precautions.

Switch-Rated plugs and receptacles enable quick motor change-outs.

Specialized Personnel may not be Required on Site

Because there is no electrical work to be performed and no concern about access to live parts when making and breaking connections with switch-rated plugs and receptacles, mechanics can quickly changeout motors with pre-wired replacements.

No Hazard/No PPE Required

Making and breaking electrical connections with MELTRIC's Switch-Rated plugs and receptacles meet NFPA 70E's 'Normal Operation' definition, so no special personal protective equipment is required. There is no need to 'suit-up' with cumbersome PPE.

Motor Change-out Process Comparison

MELTRIC Switch-Rated Plugs & Receptacles

Mechanics can quickly and safely make and break electrical connections, without special PPE.

1. Switch receptacle to 'off' position
2. Remove plug from receptacle
3. Apply lockout/tagout
4. Remove old/install new motor
5. Remove lockout/tagout
6. Insert plug into receptacle

- Changeout downtime is reduced by up to 50%.
- Equipment and installation costs are reduced by eliminating the need for interlocks and safety switches.
- Maintenance efficiency is improved by allowing mechanics to perform changeouts. Pre-wiring can be done at a convenient time in the electrical shop helping to ensure proper motor rotation.

Typical Disconnect Switch

After operating the disconnect switch, a workerstill needs to verify deenergization. Exposure to live parts is inevitable, so PPE is required.

1. Switch disconnect to 'off' position
2. Apply lockout/tagout
3. Perform Shock/Arc Flash Risk Assessment
4. Obtain permit for energized electrical work
5. Suit up with appropriate PPE
6. Remove the disconnect switch cover
7. Voltage test to verify deenergization
8. Disconnect motor from hard-wiring
9. Remove old/install new motor
10. Connect new motor to hard wiring
11. Remove lockout/tagout
12. Turn disconnect to the 'ON' position
13. Remove and store PPE

PROBLEMS

MELTRIC receptacles can be added to existing disconnects to avoid PPE requirements for voltage testing.

Make and Break Electrical Connections

Simply, Safely and in Compliance with NFPA 70E®

Use MELTRIC Switch-Rated Plugs and Receptacles

DSN

- 20 – 150 A, 600 VAC
- .75 – 75 hp
- Compact and lightweight
- Type 4X, IP66/IP67 and IP69/IP69K
- Configurable with up to 6 auxiliary contacts
- Fiberglass reinforced thermoplastic poly casings resist shock, chemicals, and UV rays

DS

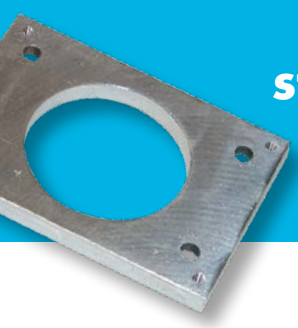
- 20 – 200 A, 600 VAC
- .75 – 100 hp
- Type 3R or 4X
- Larger wiring capacity, rugged durability
- Configurable with up to 6 auxiliary contacts
- Available in fiberglass reinforced thermoplastic poly or zinc alloy casings – both materials resist shock, chemicals, and UV rays

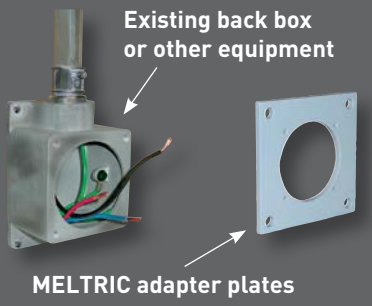
Ratings

- **UL and CSA Listed:**
  - UL 1682
  - UL 2682
  - CSA C22.2 No. 182.1
- **UL and CSA Switch-Rated per UL 2682 and Listed for:**
  - Motor Circuit Disconnect Switching
  - Branch Circuit Disconnect Switching
- **Short Circuit Rated**
  - Up to 100kA closing and withstand with RK1 current limiting fuses

*+ Testing was performed with RK1 current limiting fuses sized at 400% of the highest full load motor ampacity associated with the devices hp ratings. Visit **meltric.com** to confirm ratings.*

Easily update existing equipment with standard MELTRIC adapter plates





Plug into SAFETY with MELTRIC

Manufactured in the USA

meltric.com
4765 W. Oakwood Park Drive • Franklin, WI 53132
414-433-2700 • Fax 414-433-2701

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SAFETY FIRST

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SAFETY FIRST

Eliminate the Hazards of Standard Plugs and Receptacles

SAFE

Switch-Rated Plugs and Receptacle

Pressing the pawl on the switch-rated receptacle breaks the electrical connection. The deenergized plug can then be safely withdrawn.

SAFETY FIRST

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- Silver-nickel butt-style contacts withstand arcing and resist welding, allowing them to close into and withstand short circuit currents as high as 100kA.
- Enclosed arc chambers and dead front construction prevent exposure to arcing and eliminate unintended access to live parts.

Switch-rated plugs and receptacles from MELTRIC provide a secure and foolproof means of ensuring user safety without the need for interlocks and safety switches required with other types of plugs and receptacles. At no time is a user exposed to live contacts while connecting or disconnecting.

HAZARDOUS

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MELTRIC Switch-Rated Plugs and Receptacle

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PROBLEMS

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12. Turn disconnect to the 'ON' position
13. Remove and store PPE

MELTRIC receptacles can be added to existing disconnects to avoid PPE requirements for voltage testing.

ELIMINATE THE HAZARDS
of Standard Plugs & Receptacles

Pressing the pawl on the switch-rated receptacle breaks the electrical connection. The deenergized plug can then be safely withdrawn.

MELTRIC DS and DSN series switch-rated plugs and receptacles are designed and rated to function as a switch. Users can safely make and break connections, even in overload conditions.

- Silver-nickel contacts resist wear and maintain superior conductivity even in wet and corrosive environments.
- Silver-nickel butt-style contacts withstand arcing and resist welding, allowing them to close into and withstand short circuit currents as high as 100kA.
- Enclosed arc chambers and dead front construction prevent exposure to arcing and eliminate unintended access to live parts.

Switch-rated plugs and receptacles from MELTRIC provide a secure and foolproof means of ensuringuser safety without the need for interlocks and safety switches required with other types of plugs and receptacles. At no time is a user exposed to live contacts while connecting or disconnecting.

MOTOR CHANGE-OUT
Process Comparison

Mechanics can quickly and safely make and break electrical connections, without special PPE.

1. Switch receptacle to 'off' position
2. Remove plug from receptacle
3. Apply lockout/tagout
4. Remove old/install new motor
5. Remove lockout/tagout
6. Insert plug into receptacle

- Changeout downtime is reduced by up to 50%.
- Equipment and installation costs are reduced by eliminating the need for interlocks and safety switches.
- Maintenance efficiency is improved by allowing mechanics to perform changeouts. Pre-wiring can be done at a convenient time in the electrical shop and can help ensure proper motor rotation.

Standard Plugs and Receptacles

Most traditional plugs and receptacles should never be connected or disconnected under load.

Standard pin and sleeve and twist type plugs and receptacles are not intended to be disconnected or connected under load. Doing so can be very hazardous.

- The electrical properties of their brass contacts degrade significantly from oxidation and wear occuring with normal use.
- Because brass cannot withstand arcing, the contacts may v aporize and cause an arc flash if connected or disconnected in overload conditions.
- Live front designs expose users to live parts and also to the arcing or arc blasts that may result from their use in adverse conditions.

Because nothing prevents these devices from being connected and disconnected under load in many applications, users are often exposed to these hazards. When interlocks are provided, their function is often defeated by the use of extension cords.

Typical Disconnect Switch

After operating the disconnect switch, a worker still needs to verify deenergization. Exposure to live parts is inevitable, so PPE is required.

PROBLEMS

1. Switch disconnect to 'off' position
2. Apply lockout/tagout
3. Perform Shock/Arc Flash Risk Assessment
4. Obtain permit for energized electrical work
5. Suit up with appropriate PPE
6. Remove the disconnect switch cover
7. Voltage test to verify deenergization
8. Disconnect motor from hard-wiring
9. Remove old/install new motor
10. Connect new motor to hard wiring
11. Remove lockout/tagout
12. Turn disconnect to the 'ON' position
13. Remove and store PPE

MELTRIC receptacles can be added to existing disconnects to avoid PPE requirements for voltage testing.