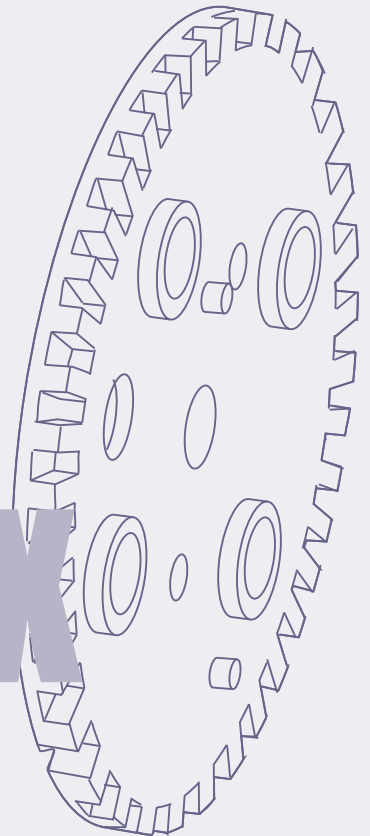
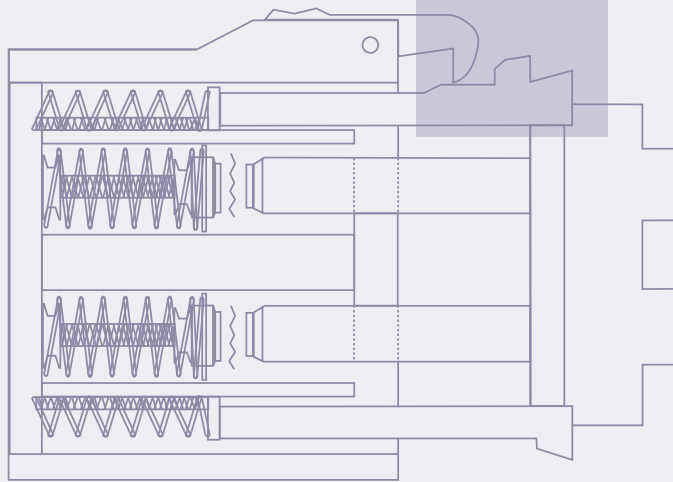
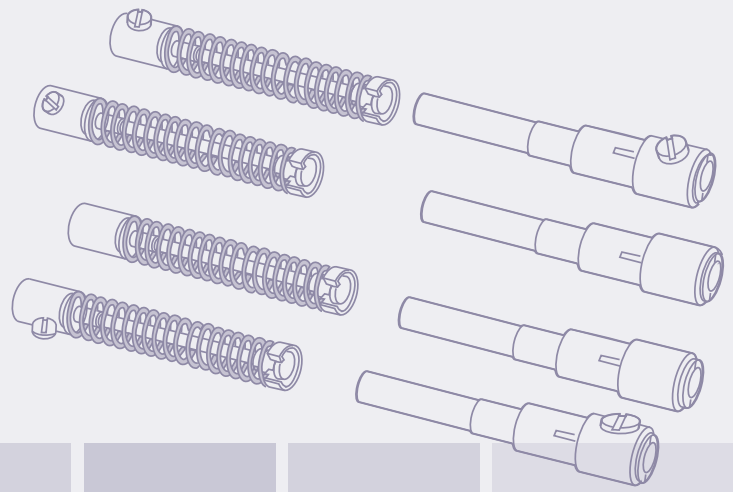


# Technical Manual



# NEMA 4X



# Technical Manual

|   |               |
|---|---------------|
| <b>Switch Ratings vs Current Interrupting Ratings</b> | <b>p. 183</b> |
| <b>Electrical Performance</b>                         | <b>p. 184</b> |
| <b>Butt-Contact Technology</b>                        | <b>p. 187</b> |
| <b>Dead-Front Construction</b>                        | <b>p. 189</b> |
| <b>Keying System</b>                                  | <b>p. 190</b> |
| <b>Dual Voltage Devices</b>                           | <b>p. 190</b> |
| <b>Resistance to Environments and Chemicals</b>       | <b>p. 191</b> |
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| <b>Impact Resistance</b>                              | <b>p. 194</b> |
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# Electrical Performance – Switch Rated, Current Interrupting Rated and Non-Current Interrupting Rated Devices

## Switch Rated Plugs & Receptacles

Meltric's DECONTACTOR™ Series products are UL & CSA listed as switch rated plugs and receptacles. These ratings allow them to be used as a motor circuit disconnect switch, as well as a branch circuit disconnect switch. Switch rated plugs and receptacles have passed electrical overload, short circuit and endurance tests that are far more rigorous than those applied to other plugs and receptacles. These tests include the functional requirements for safety disconnect switches in addition to manual motor controllers. For more information about the tested electrical performance of switch rated devices consult pages 184 - 186.

## Current Interrupting Rated Plugs & Receptacles

Other Meltric devices such as the DXN plugs and receptacles are UL and CSA rated for “current interrupting”. A current interrupting rated plug and receptacle is not subjected to the same level of endurance testing as a switch rated device and does not need to be subjected to any overload-locked rotor or short circuit testing (see pages 184 - 186 for performance test comparisons). Plug and receptacles rated for “current interrupting” are not intended to be used as switches, but can withstand making and breaking of normal resistive loads. Devices that are not hp and short circuit rated are not intended to make and break motor loads or other inductive loads.

## Non-Current Interrupting Rated Plugs & Receptacles

Many competitive plugs and receptacles, as well as some Meltric devices are “non-current interrupting” rated. They are not approved by UL or CSA for connecting or disconnecting under load. They have passed the minimum test requirements for plugs and receptacles but they have not passed current interrupting performance tests or the more demanding electrical endurance, overload and short circuit tests required of switch rated devices. For more information about the tested electrical performance of non-current interrupting rated devices consult pages 184 - 186.

| Ratings                        | Product                           |
|--------------------------------|-----------------------------------|
| Switch Rated                   | DSN                               |
|                                | DS                                |
|                                | DB                                |
| Current Interrupting Rated     | DXN                               |
|                                | Multipin                          |
|                                | DR                                |
|                                | PN                                |
|                                | DX,<br>Competitors Pin and Sleeve |
| Non-Current Interrupting Rated | Multipin                          |
|                                | PF/PFQ                            |
|                                | Competitors Pin and Sleeve        |



# Electrical Performance

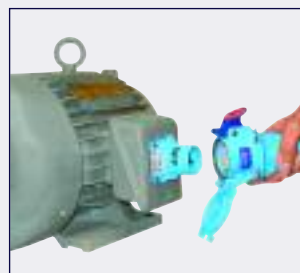
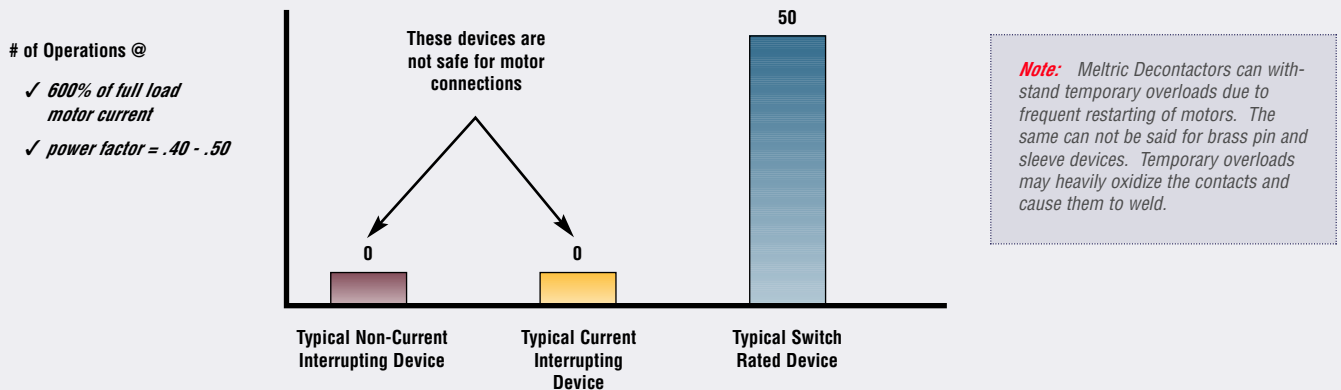
## Overload Conditions

UL & CSA standards for plugs and receptacles require that the devices be able to withstand overload conditions. General use conditions are simulated by testing a device to a specified number of operations (50) at 150% of rated current and a power factor between 0.75 and 0.80. Switch rated plugs and receptacles that are horsepower rated must perform overload testing at 600% of full load motor current with a more severe power factor (between 0.40 and 0.50) to simulate locked rotor conditions.

### UL & CSA Standards – Overload Test Requirements and Ratings Comparisons

| Test  | UL 1682 & CSA 22.2 No. 182.1                                   |  | UL Subject 2682<br>(used for both UL & CSA listings)                     |
|---|--|--|--|
|   | Plugs, Receptacles & Cable Connectors of the Pin & Sleeve Type |  | Switch Rated Plugs & Receptacles   |
|   | Non-Current Interrupting (Typical)                             | Current Interrupting (Typical)                                 | Motor / Branch Circuit Switch Rated (Typical)                            |
| Overload<br>(General Use Devices)                     | 3 Operations<br>@ 150% of Rated Current<br>(p.f. = .75 - .80)  | 50 Operations<br>@ 150% of Rated Current<br>(p.f. = .75 - .80) | 50 Operations<br>@ 150% of Rated Current<br>(p.f. = .75 - .80)           |
| Overload - Locked Rotor<br>(Horsepower Rated Devices) | -  | -  | 50 Operations<br>@ 600% of Full Load Motor Current<br>(p.f. = .40 - .50) |

### Test Results: Completed Operations at Overload/Locked Rotor Condition



Motors and other equipment can be quickly and safely connected or disconnected with Meltric's Switch Rated DECONTACTOR™ Series plug and receptacles.

# Electrical Performance

## Mechanical and Electrical Endurance

UL and CSA standards require endurance testing to ensure that rated performance is maintained over the expected life of the device. The severity of this testing depends on the rating of the device.

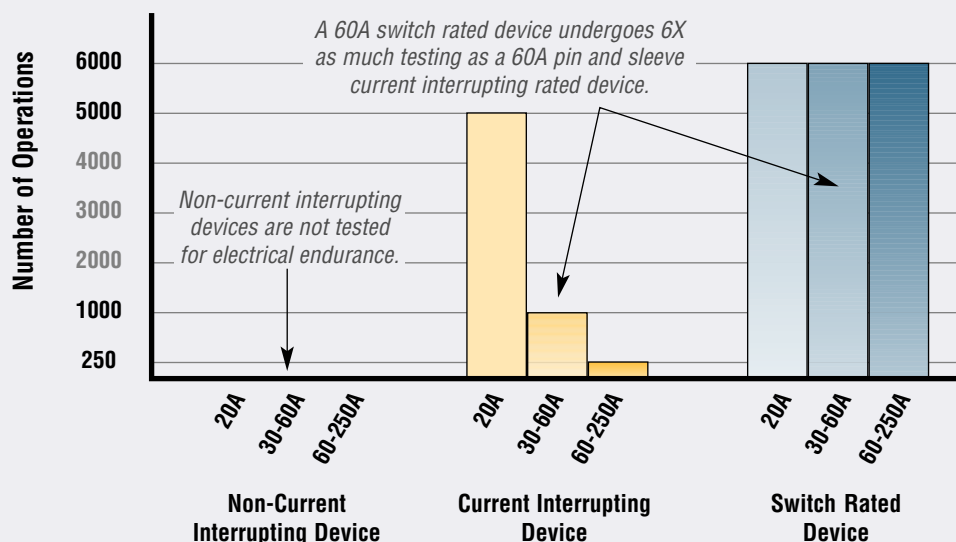
As shown in the chart below, non-current interrupting devices are tested only for mechanical endurance. Current interrupting devices are additionally subjected to moderate electrical endurance testing, and switch rated devices are subjected to a much more severe level of electrical endurance testing, which is similar to that required of disconnect switches. In this regard, switch rated devices may be required to make and break under full load more than 20 times as many operations (depending upon device amperage) as a current interrupting rated pin and sleeve device.

### UL & CSA Standards – Endurance Test Requirements and Ratings Comparisons

| Test                                | UL 1682 & CSA 22.2 No. 182.1   |   | UL Subject 2682<br>(used for both UL & CSA listings)               |
|-------------------------------------|--|---|--|
|                                     | Plugs, Receptacles & Cable Connectors of the Pin & Sleeve Type                   |   | Switch Rated Plugs & Receptacles                                   |
|                                     | Non-Current Interrupting   | Current Interrupting  | Motor / Branch Circuit Switch Rated                                |
| Mechanical Endurance<br>(no load)   | 15-20A = 5000 Operations<br>21-63A = 2000 Operations<br>64-250A = 250 Operations | 15-20A = 0 Operations<br>21-63A = 1000 Operations<br>64-250A = 500 Operations   | 6000 Operations<br>(Covered by Electrical Endurance testing)       |
| Electrical Endurance<br>(With Load) | -  | 15-20A = 5000 Operations<br>21-63A = 1000 Operations <sup>1</sup><br>64-250A = 250 Operations <sup>1</sup><br>@ Rated Current & Voltage<br>(p.f. = .75 - .80) | 6000 Operations<br>@ Rated Current & Voltage<br>(p.f. = .75 - .80) |

**Notes:** <sup>1</sup> Testing alternates between mechanical & electrical operations. This reduces the severity of the electrical test by allowing additional cooling time during electrical testing.

### Electrical Endurance Test Comparison



# Electrical Performance

## Short Circuit Protection

Meltric's Decontactors (DS, DSN, and DB products) have successfully completed high fault current short circuit testing. All these devices have short circuit make (close) and withstand ratings of either 65 kA or 100 kA. UL witnessed and approved this testing.

### UL Recognized Short Circuit Capabilities

| UL Recognized Short Circuit Capabilities |                               |               |                        |
|--|-------------------------------|---------------|------------------------|
| Plug & Receptacle Type                   | Short Circuit Ratings Product |               | Standard               |
|  | Withstand                     | Make          |                        |
| General Use Pin & Sleeve Devices         | None                          | None          | UL 1682                |
| HP Rated Twist-Type Devices              | 1kA                           | None          | UL 498                 |
| Motor Rated Pin & Sleeve Devices         | 10kA                          | None          | UL 1682                |
| <b>Meltric Decontactors</b>              | <b>≥ 65kA</b>                 | <b>≥ 65kA</b> | <b>UL Subject 2682</b> |

### Short Circuit Test Information

#### Fusing

The amperage and time delay characteristics of the fusing used in testing affects the electrical load seen by the device. UL Subject 2682 requires short circuit tests be performed with fuses having an amperage rating that is no less than 400% of full load motor ampacity for horsepower rated devices, or no less than 100% of the device's amperage rating for general use devices.

Meltric used RK1 non-time delay type fusing for the horsepower rated devices because it is a common type of fuse used in motor applications. Meltric selected RK5 Time Delay fusing for the non-horsepower rated devices (DS9 & DS2) because it represents the most severe case of the various fusing scenarios that are typically used for general use applications.

#### Power Factor

The lower the power factor (p.f.) the more rigorous the test. UL Subject 2682 requires short circuit testing at 42,000 amps and above to be performed with a p.f. of 0.15 or less. By comparison, the p.f. for the 10,000 amp short circuit withstand test required by UL 1682 for horsepower rated plugs & receptacles, is a much less rigorous 0.50.

### Short Circuit Test Summary Table

| Device Information |                    |                            | Short Circuit Make & Withstand Rating <sup>1</sup> |     |                        |       |
|--------------------|--------------------|----------------------------|--|-----|------------------------|-------|
| Model              | General Use Rating | Max Motor FLA <sup>1</sup> | kA   | VAC | Fusing used in Testing |       |
| DSN20              | 20A                | 8A (2 hp @ 208 VAC)        | 100  | 480 | RK1                    | 35A   |
| DSN30              | 30A                | 18A (15 hp @ 600 VAC)      | 100  | 600 | RK1                    | 125A  |
| DSN60              | 60A                | 27A (20 hp @ 480 VAC)      | 100  | 600 | RK1                    | 110A  |
| DS20               | 20A                | 11A (3 hp @ 208 VAC)       | 100  | 600 | RK1                    | 80A   |
| DS30               | 30A                | 14A (10 hp @ 480 VAC)      | 100  | 600 | RK1                    | 125A  |
| DS60               | 60A                | 27A (25 hp @ 600 VAC)      | 100  | 600 | RK1                    | 250A  |
| DS100C             | 100A               | 27A (25 hp @ 600 VAC)      | 100  | 600 | RK1                    | 250A  |
| DS100              | 100A               | -                          | 65   | 600 | RK5 TD                 | 100A  |
| DS200              | 200A               | -                          | 65   | 600 | RK5 TD                 | 200A  |
| DB30               | 30A                | 26A (7.5 hp @ 208 VAC)     | 100  | 600 | RK1                    | 125A  |
| DB60               | 60A                | 49A (15 hp @ 208 VAC)      | 100  | 600 | RK1                    | 250A  |
| DB100              | 100A               | 92A (30 hp @ 208 VAC)      | 100*   | 600 | RK1                    | 250A* |

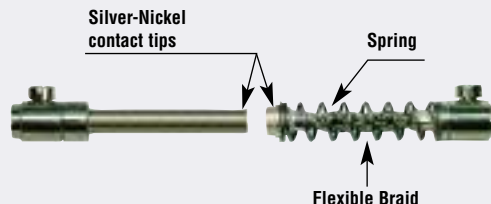
<sup>1</sup> The maximum associated with any of the devices horsepower ratings. The fusing used in the short circuit testing must be at least 400% of this value in order for the short circuit rating to apply to the hp rating.

\* The fusing used limits the 100kA rating to 60hp @ 600V, 40hp @ 480V, 20hp @ 240V & 208V

# Technical Manual

## Contact Technology

Meltric products feature silver-nickel, spring-loaded butt contacts similar to those used in motor starters and contactors.



### Silver-Nickel Contact Material

Meltric uses solid silver-nickel (85%/15%) contacts. The silver-nickel material has significant advantages over the brass contacts commonly used on competitive devices.

Silver has very low initial contact resistance and is not negatively affected by oxidation. This helps to give it excellent electrical properties that are maintained even at high temperatures and after tarnishing. Nickel is a much harder material and contributes excellent mechanical properties. The combination of silver and nickel results in a contact material that has both superior electrical capabilities and excellent resistance to wear. Silver-nickel only welds at extremely high pressure and temperature, and thus, also withstands arcs very well. These features make silver-nickel a commonly used contact material by switchgear manufacturers.

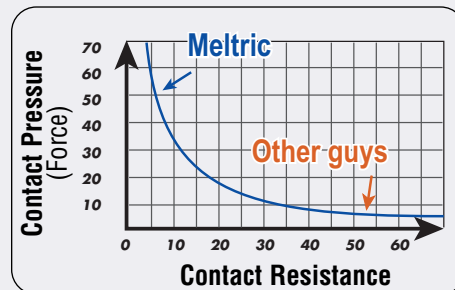
By contrast, the brass material used in most competitive plugs and receptacles has much higher initial contact resistance and is negatively affected by oxidation. In an oxidized state, the contact resistance of brass is more than 20 times higher than that of silver-nickel. In addition, brass is a soft material that wears rapidly. In use, brass pin and sleeve and arcuate contacts suffer from the combined effects of the limitations of the material and the design. As oxidation and wear induced reductions in contact force occur, contact resistance increases. This increases operating temperature, which causes further oxidation and wear, perpetuating a vicious cycle of degradation. Brass is not arc resistant and is not suitable for making and breaking under load.

| MATERIAL      | CONTACT RESISTANCE |                  |
|---------------|--------------------|------------------|
|               | New                | Oxidized         |
| SILVER        | 6 $\mu\Omega$      | 25 $\mu\Omega$   |
| SILVER-NICKEL | 23 $\mu\Omega$     | 60 $\mu\Omega$   |
| COPPER        | 29 $\mu\Omega$     | 400 $\mu\Omega$  |
| BRASS         | 370 $\mu\Omega$    | 1400 $\mu\Omega$ |

*In an oxidized state, silver-nickel is 20 times more conductive than brass.*

### Spring-Loaded Contacts

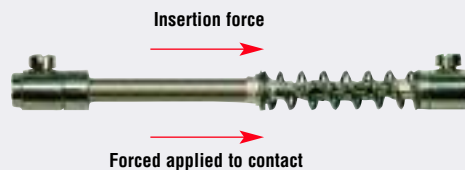
Spring-loading of the contacts ensures that optimal pressure between the contacts is maintained – even after tens of thousands of operations. This point is important because contact force is a key determinant of the quality of the connection. As the accompanying graph demonstrates, contact resistance increases as contact force decreases. Higher contact resistance generates more heat and oxidation, both of which contribute to the deterioration of the contact. This is a problem with pin and sleeve and arcuate type contacts because their contact force varies with manufacturing tolerances and is reduced due to wear that occurs with normal use.



*Higher contact pressure leads to lower contact resistance.*

### Butt-Style Connection

Meltric's butt-style contact configuration provides a positive and secure connection and also makes connection and disconnection easy. With butt contacts, the force applied to the contacts is in-line with the insertion motion, so inserting a plug into it's socket requires only a known and limited amount of effort. Contact wear and sensitivity to manufacturing tolerances is negligible, because the spring-loading is sufficient to compensate for minor differences in contact length.



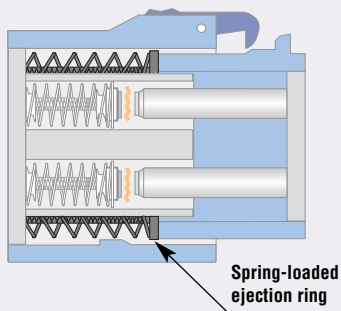
*With Meltric's butt contacts the force applied to the contacts is in-line with the insertion motion.*

With the pin and sleeve design used by our competitors, the contact force is at a right angle to the insertion/withdrawal force. There are numerous drawbacks to such a design:

- ▼ The contact pressure must be sufficient to prevent excessive temperature rise but is limited by the need to keep the insertion force reasonable.
- ▼ The necessary friction wears out the contacts, and diminishes contact pressure over time.
- ▼ Normal manufacturing tolerances result in wide variations in performance, even with new devices.
- ▼ The sliding contact design does not make & break cleanly, so arcing is more likely to occur.

### Quick Break Mechanism

On most Meltric devices, the circuit is broken simply by depressing the pawl. Doing so releases the energy in a spring-loaded operating mechanism, which instantaneously breaks the circuit and ejects the plug to the 'OFF' position. Contact breaking time is about 15 milliseconds. The quick break mechanism is automatically reloaded when the plug is re-inserted.

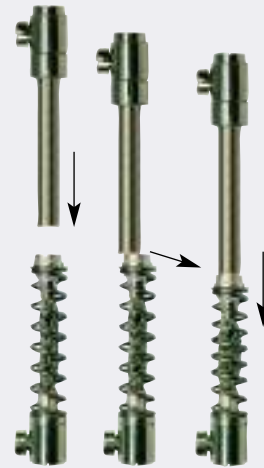


*Spring-loaded ejection system ensures a quick break of the contacts.*

In contrast, the disconnection speed of pin and sleeve and twist type devices is dependent on the users motion when removing the plug.

### Self Cleaning System

Meltric contacts close with a self-cleaning, wiping action. When the contacts initially mate, they are slightly offset. In completing the connection, the plug contacts are rotated partially across the receptacle contacts, helping to remove deposits from the contact surface.



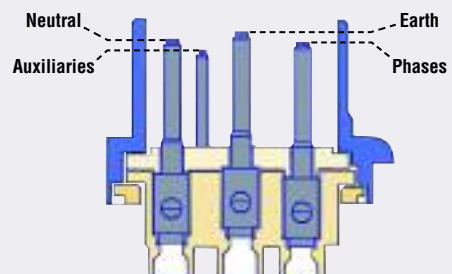
*Meltric contacts are self cleaning.*

### Contact Mating Sequence

Decontactor contacts mate in a specific sequence to ensure a proper and safe connection.

1. The earth (ground) closes first
2. Then the neutral,
3. Then the phases,
4. Then the auxiliary contacts, if any. These auxiliary contacts can, therefore, be used as "pilot" contacts.

On opening, the sequence is reversed.



*The contacts are set in the plug at different levels to achieve the desired mating sequence.*



# Technical Manual

## Dead Front and Enclosed Arc Chambers For Maximum Protection from Live Parts

Most Meltric receptacles feature a dead front which encloses and isolates the live contacts when the plug is removed. Only electrically compatible plugs can unlock the safety shutter and gain access to the live parts. In addition to preventing accidental exposure to live parts, the safety shutter also keeps the contacts clean and out of reach even if the lid is left open.



The receptacle's dead front protects workers from accidental tool and wire insertion.

### Protection During the Making and Breaking Process

When disconnecting or connecting a Meltric plug from/to a receptacle, the user is completely protected from exposure to arc flash or live parts. This is because the contacts can only make or break while they are enclosed in internal arc chambers within the receptacle.

During disconnection, the pressing of the pawl on the receptacle breaks the connection (inside the arc chambers) and ejects the plug to its rest or "OFF" position. While in the rest position, the plug and receptacle casings maintain a dead front and thus protect the user from live parts. The plug can not be fully withdrawn until it is rotated 30° counterclockwise. This closes and locks the safety shutter preventing access to live parts during and after the removal of the plug.

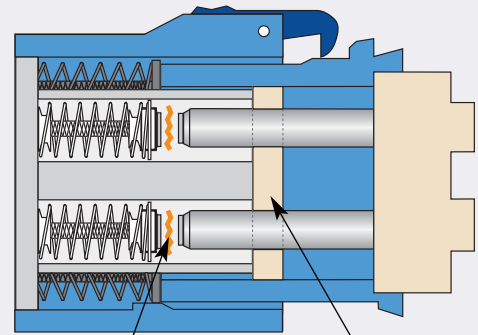
During connection, the plug contacts can only access the receptacle contacts after the plug has been partially inserted into the receptacle and has then been rotated 30° to open the safety shutter. Because the interaction of the skirted plug casing with the receptacle forms a protective enclosure that prevents access to the contacts as soon as insertion begins, a dead front is maintained even after the safety shutter is opened. Once the safety shutter has been opened, the plug contacts can be safely inserted into the arc chambers where the connection is made as the plug is latched to the receptacle.

### Protection from Insertion of Inappropriate Plugs

Meltric products offer up to 24 different keying positions. Only plugs and receptacles that are keyed/notched in the same positions will mate with each other. Non-compatible plugs will be unable to open the safety shutter. This system prevents potentially dangerous situations. For example, a 250V plug (notch 16) can not be inserted into a 480V receptacle (notch 04). Alternatively, on the PF and DX series, pegs and holes perform the same function as the notches.

**Note:** Some of the keying positions have been assigned to a designated global voltage. A few others are unassigned and are available if a user prefers to limit mating of plugs and receptacles that are only to be used on particular applications.

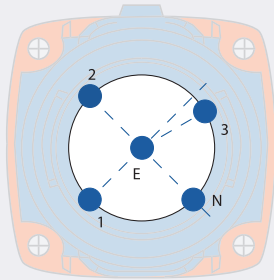
**Note:** *Coding Disk* Some receptacles utilize a coding disk which performs the same functions as does the one piece safety shutter.



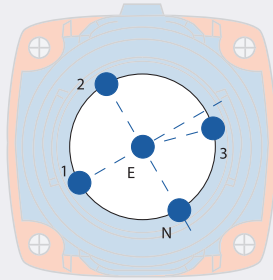
Arc chamber prevents outside exposure to arc flash.

Safety shutter prevents finger or tool access to live parts.

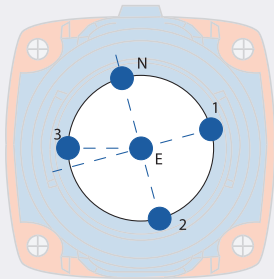
## Commonly Used Keying Positions



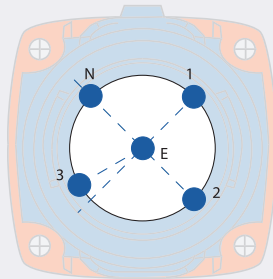
**Position 04**  
255-277V/440-480V 60Hz



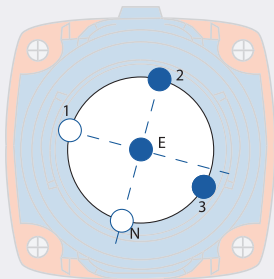
**Position 07**  
110-125/220-250V 50Hz



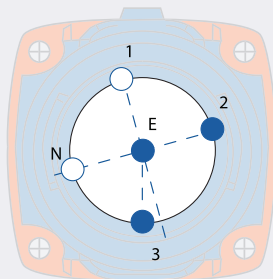
**Position 14**  
347/600V 60Hz



**Position 16**  
120-127V/208-220V 60Hz



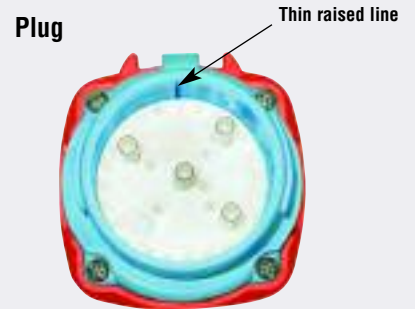
**Position 02**  
20-24V DC



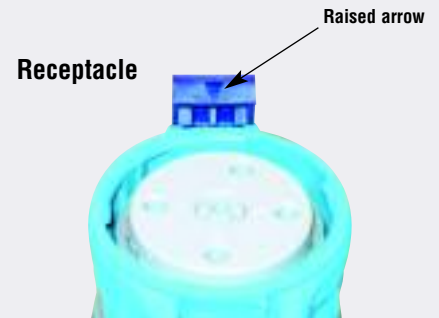
**Position 20**  
220-250V DC

*Note:* See chart on page 13 for a complete list of voltage polarization positions and associated voltages.

## How to Identify Keying Positions of an Existing Device



The keying position of most Meltric plugs can be determined by looking at the plug interior and finding a thin, raised line in the casing. This line is always directly above a number that identifies the plug's keying position.



The keying position for most receptacles can be determined by identifying a raised arrowhead (usually on the pawl or on the casing next to the pawl). This arrow points to a key number that can be found on the ring that surrounds the safety shutter.

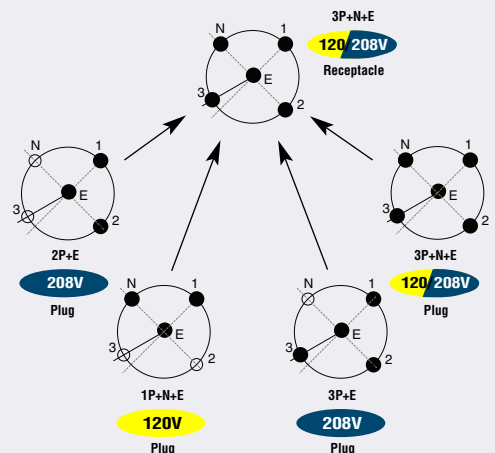
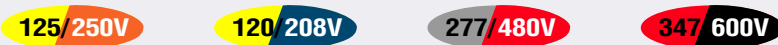
## Dual Voltage Devices Maximize User Flexibility

Some Meltric receptacles are designed to safely allow dual voltage capabilities.

For example, a 208V rated 3P+N+E receptacle will safely provide power to several configurations of 208V plugs and a single phase 120V plug. Having two voltages delivered by a single receptacle allows some facilities to significantly reduce the number of receptacles that need to be installed.

Dual voltage receptacles are supplied with dual color coded voltage stickers.

## Dual Voltages Typically Available from Meltric



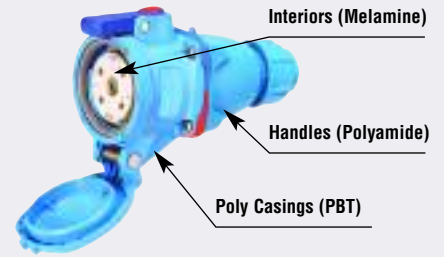
# Device Materials and their Resistance to Environments and Chemicals

## Polymeric Materials

**Casings** – The common technical name for the “Poly” material used by Meltric is PBT or PBTP (Poly Buthylene Tere Phthalate). It consists of a special blend of thermoplastic polyester, fiberglass and elastomers which provides outstanding resistance to most chemical agents and environmental conditions, including UV and gamma rays. This material also offers high impact resistance across a broad spectrum of temperatures (shock resistance ratings to IK08).

**Interiors** – The arc chambers for most Meltric devices are made of Melamine or of a special compound of thermoplastic polyester, fiberglass, and elastomer. Other materials are used such as Polyamide and Bakelite.

**Accessories** – Handles, angles and wall boxes are made of Polyamide (they are supplied with self tapping screws).



| Products with Poly (PBT) casings |
|----------------------------------|
| DSN20, DSN30, DSN60              |
| DS20, DS30, DS60, DS100, DS100C  |
| DR30, DR50, DR100, DR150         |
| DXN20, DXN30, DXN60              |
| DSN24, DSN37, DS7, DR7           |

## Resistance of Polymeric Casings to Various Chemical Agents

| Agent                 | Polyester reinforced glass fiber |      |      | Polyamide |      |      |
|-----------------------|----------------------------------|------|------|-----------|------|------|
|                       | 23°C                             | 60°C | 80°C | 23°C      | 60°C | 80°C |
| Butyl acetate         | ☆☆                               | ☆☆   |      | ☆☆        |      |      |
| Ethyl acetate         | ☆                                |      |      | ☆☆        |      |      |
| Acetone               | ☆                                |      |      | ☆☆        |      |      |
| Acetic acid           | 5%                               | ☆☆   | ☆☆   | ☆         | ☆    | -    |
|                       | 10%                              | ☆☆   | ☆    | ☆         | -    | -    |
| Hydrochloric acid     | 10%                              | ☆☆   | ☆☆   | ☆☆        | ☆    | -    |
| Chromic acid          | 40%                              | ☆☆   | ☆☆   | ☆☆        | -    | -    |
| Citric acid           | 10%                              | ☆☆   | ☆☆   | ☆☆        | ☆    |      |
| Formic acid           | 5%                               | ☆☆   | ☆    | ☆☆        | ☆    |      |
| Nitric acid           | 10%                              | ☆☆   | ☆    | ☆☆        | ☆    | -    |
| Oleic acid            | 100%                             | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Phosphoric acid       | 3%                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
|                       | 30%                              | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
|                       | 85% (conc)                       | ☆☆   | ☆☆   | ☆☆        | -    | -    |
| Sulphuric acid        | 3%                               | ☆☆   | ☆☆   | ☆☆        | -    | -    |
|                       | 30%                              | ☆☆   | ☆☆   | ☆☆        | -    | -    |
| Ethyl alcohol         |                                  | ☆☆   |      | ☆☆        |      |      |
| Methyl alcohol        |                                  | ☆☆   |      | ☆☆        |      |      |
| Aniline               |                                  | ☆☆   |      | -         |      |      |
| Benzene               |                                  | ☆    | ☆    | ☆☆        |      |      |
| Soda Bicarbonate      | 10%                              | ☆☆   | ☆    | -         | ☆☆   | ☆☆   |
| Potassium bichromate  | 10%                              | ☆☆   |      |           | ☆☆   | ☆☆   |
| Sodium bisulphate     | 10%                              | ☆☆   | ☆    | -         | ☆☆   | ☆☆   |
| Butane                |                                  | ☆☆   |      | ☆☆        |      |      |
| Butanol               |                                  | ☆    | ☆    | ☆☆        |      |      |
| Soda carbonate        | 10%                              | ☆☆   | -    | -         | ☆☆   | ☆☆   |
|                       | 20%                              | ☆☆   | -    | -         | ☆☆   | ☆☆   |
| Disulphuric carbonate |                                  | ☆☆   |      | ☆☆        |      |      |
| Calcium chloride      | 10%                              | ☆☆   | ☆☆   |           | ☆☆   |      |
| Potassium chloride    | 10%                              | ☆☆   | ☆    | -         | ☆☆   |      |
| Sodium chloride       | 10%                              | ☆☆   | ☆    | -         | ☆☆   |      |
| Detergents            | 1%                               | ☆☆   | ☆    | -         | ☆☆   | ☆☆   |
|                       | 25%                              | ☆☆   | ☆    | -         | ☆☆   | ☆☆   |
| Dibutylphthalate      |                                  | ☆☆   | ☆☆   |           | ☆☆   |      |
| Dichlorethane         |                                  | -    |      | ☆☆        |      |      |
| Dioxane               |                                  | ☆☆   | -    | ☆☆        |      |      |
| Water                 |                                  | ☆☆   | ☆☆   | -         | ☆☆   | ☆☆   |
| Bleach                |                                  | ☆☆   | ☆☆   |           | ☆☆   |      |
| Gas                   |                                  | ☆☆   |      | ☆☆        |      |      |
| Turpentine            |                                  | ☆☆   |      | ☆☆        |      |      |

| Agent                  | Polyester reinforced glass fiber |      |      | Polyamide |      |      |
|------------------------|----------------------------------|------|------|-----------|------|------|
|                        | 23°C                             | 60°C | 80°C | 23°C      | 60°C | 80°C |
| White spirit           | ☆☆                               |      |      | ☆☆        |      |      |
| Ether                  | ☆☆                               |      |      | ☆☆        |      |      |
| Freon 11               | ☆☆                               |      |      | ☆☆        |      |      |
| Glycerine              | ☆                                | ☆    |      | ☆☆        | ☆    | -    |
| Glycol                 | ☆                                | ☆    |      | ☆☆        | ☆    | -    |
| Grease                 | ☆☆                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Heptane                | ☆☆                               |      |      | ☆☆        |      |      |
| Hexane                 | ☆☆                               |      |      | ☆☆        |      |      |
| Cotton seed oil        | ☆☆                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Silicon oil            | ☆☆                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Processing oil         | ☆☆                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Diesel oil             | ☆☆                               |      |      | ☆☆        |      |      |
| Olive oil              | ☆☆                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Mineral oil            | ☆☆                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Engine oil             | ☆☆                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Plant oil              | ☆☆                               | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Ammonium hydroxide     | 10%                              | ☆    |      | ☆☆        |      |      |
|                        | conc                             | -    |      | ☆☆        |      |      |
| Potassium hydroxide    | 1%                               | -    | -    | ☆☆        |      |      |
|                        | 10%                              | -    | -    | ☆☆        |      |      |
| Sodium hydroxide       | 1%                               | -    | -    | ☆☆        |      |      |
|                        | 10%                              | -    | -    | ☆☆        |      |      |
| Calcium hypochlorite   |                                  | ☆☆   | ☆☆   | ☆☆        |      |      |
| Sodium hypochlorite    | 10%                              | ☆☆   | ☆    | -         | -    | -    |
| Isopropanol            |                                  | ☆    | ☆    | ☆☆        |      |      |
| Braking liquid         |                                  | ☆☆   | ☆☆   | ☆☆        | ☆☆   |      |
| Methylethycetone       |                                  | ☆☆   | ☆☆   | ☆☆        | ☆☆   |      |
| Perchloroethylene      |                                  | ☆☆   | ☆☆   | ☆☆        | ☆☆   |      |
| Potassium permanganate | 10%                              | ☆☆   |      |           |      |      |
| Oil                    |                                  | -    |      | -         |      |      |
| Hydrogen peroxide      | 3%                               | ☆☆   |      | -         |      |      |
|                        | 30%                              | ☆☆   |      | -         |      |      |
| Soap solution          | 1%                               | ☆☆   | -    | -         | ☆☆   |      |
| Carbon tetrachloride   |                                  | ☆☆   |      | ☆☆        |      |      |
| Tetrahydrofurane       |                                  | ☆    |      | ☆☆        |      |      |
| Toluene                |                                  | ☆☆   |      | ☆☆        |      |      |
| Trichlorethylene       |                                  | ☆☆   |      | ☆☆        | ☆☆   | ☆☆   |
| Vaseline               |                                  | ☆☆   | ☆☆   | ☆☆        | ☆☆   | ☆☆   |
| Xylene                 |                                  | ☆☆   |      | ☆☆        |      |      |

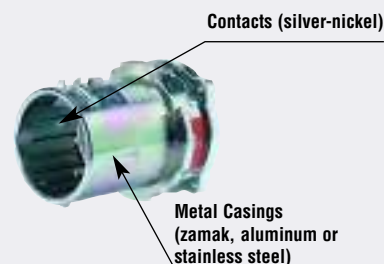
Legend: ☆☆☆ = Excellent ☆ = Good - = Poor

## Metal Materials

**Casings** – Metal casings providing even greater impact resistance are standard on some Meltric products and are optional on others. Depending upon the product line, these casings may be made of zamak, aluminum or stainless steel. Zamak, a zinc - aluminum alloy is the most commonly used. Zamak receptacles are blue epoxy coated and zamak plugs are specially treated to further improve corrosion resistance.

**Contacts** – All Meltric contact surfaces are made of solid silver-nickel with the exception of the PF and PFQ contacts which are solid pure silver. Silver-nickel and silver both provide excellent resistance to climatic conditions and to all known chemical agents found in industry with the exception of sulphuric acid. Products installed in sulphuric acid environments should have an environmental rating of at least NEMA 4X or IP 66.

**Accessories** – Wall boxes, angles, and handles are in zamak or aluminum alloy. All zamak accessories are standardly protected by an epoxy paint.



### Products with Metal Zamak casings:

DS60, DS100C, DS100, DS200

DB30, DB60, DB100

DR100, DR150, DR250

PN7, PN12, DN7, DN20, DS7, DR7

### Products with Aluminum Casings

PN (HT)

DX20, DX30, DX60, DX100

PFQ300, PF300, PF400, PF600

### Products with Stainless Steel Casings

PN12

DS24, DS37

*Contact customer service for availability of Stainless Steel on other products*

## Resistance of Metal Casings to Corrosive Agents

| Agent                   | Protected Zamak or Aluminum |
|-------------------------|-----------------------------|
| Dry lighting gas        | ☆☆                          |
| Water steam             | ☆                           |
| Hot water               | ☆                           |
| Artificial sea water    | ☆                           |
| Soluble oil 3%          | ☆                           |
| Soluble oil 5%          | ☆☆                          |
| Cleansing soap          | ☆☆                          |
| Potash solution 1%      | ☆                           |
| Potash solution 5%      | ☆                           |
| Ammonia 1%              | ☆                           |
| Ammonia 5%              | ☆                           |
| Sodium chloride 1%      | ☆                           |
| Sodium chloride 5%      | ☆                           |
| Acetic acid 1%          | ☆                           |
| Acetic acid 5%          | –                           |
| Gas                     | ☆☆                          |
| Engine oil              | ☆☆                          |
| Printing ink            | ☆                           |
| Ethyl or methyl alcohol | ☆☆                          |
| Trichloethylene         | ☆                           |
| Dry insecticides        | ☆                           |

Legend: ☆☆ = Excellent ☆ = Good – = Poor

# Technical Manual

## Watertightness / Ingress Protection (NEMA and IP ratings)

### Environmental Ratings for Meltric Devices



Most Meltric products achieve rated watertightness as soon as the plug is fully inserted into the receptacle. The primary exception is the DB product line which requires the turning of a locking ring.

| Product | NEMA | IP (plug + receptacle) | IP (receptacle alone) |
|---------|------|------------------------|-----------------------|
| DSN     | 4X   | 66+67                  | 66+67                 |
| DS+     | 3R   | 54                     | 55                    |
| DB      | -    | 67                     | 67                    |
| DXN     | 4X   | 66+67                  | 66+67                 |
| DX      | -    | 65                     | 65                    |
| DN      | -    | 54                     | 55                    |
| PF/PFQ  | -    | 66+67                  | 66+67                 |
| DR+     | 3R   | 54                     | 55                    |
| PN      | 4X   | 66+67                  | 66+67                 |
| SP      | -    | 66+67                  | 66+67                 |

\* Additional watertightness is available on DS and DR devices, see pg 174

### Environmental Ratings Explained:

#### NEMA/UL/CSA Enclosure Types (UL50)

| NEMA Enclosure Type | Intended Use and Description  |
|---------------------|---|
| 1                   | Indoor use primarily to provide a degree of protection against limited amounts of falling dirt  |
| 2                   | Indoor use primarily to provide a degree of protection against limited amounts of waste and falling dirt  |
| 3, 3R, 3S           | Outdoor use primarily to provide a degree of protection against rain, sleet, and damage from external ice formation.  |
| 4, 4X               | Indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation |
| 12                  | Indoor use primarily to provide a degree of protection against circulating dust, falling dirt and dripping non-corrosive liquids  |

#### IP Ratings (IEC/EN 60529)

| First Digit   |                   | Second Digit   |   |
|---|-------------------|--|---|
| Protection against the ingress of solid foreign objects and access to hazardous parts |                   | Protection against the ingress of water with harmful effects |   |
| 0   | No protection     | 0  | No protection                             |
| 1   | 50mm Back of hand | 1  | Vertically dripping water (condensation)  |
| 2   | 12.5mm Finger     | 2  | Dripping water at 15°                     |
| 3   | 2.5mm Tool        | 3  | Spraying water at 60° (rain)              |
| 4   | 1mm Wire          | 4  | Splashing water from any direction        |
| 5   | Against Dust -    | 5  | Jetting water from any direction          |
| 6   | Dust-tight -      | 6  | Powerful jetting water from any direction |
| -   |                   | 7  | Temporary submersion                      |

# Impact Resistance

Meltric product resistance to mechanical shocks is specified in accordance with their IK ratings.

## Meltric Products IK Ratings (per IEC/EN 50102)

| Product | Material | IK Rating      |
|---------|----------|----------------|
| DSN     | Poly     | 08 (5 Joules)  |
| DS      | Poly     | 08 (5 Joules)  |
| DS      | Metal    | 09 (10 Joules) |
| DB      | Metal    | 09 (10 Joules) |
| DR      | Poly     | 08 (5 Joules)  |
| DR      | Metal    | 09 (10 Joules) |
| DN      | Metal    | 09 (10 Joules) |
| PN      | Poly     | 08 (5 Joules)  |
| PN      | Metal    | 09 (10 Joules) |
| PF      | Metal    | 10 (20 Joules) |
| DX      | Metal    | 10 (20 Joules) |
| DXN     | Poly     | 08 (5 Joules)  |



# Operating Temperatures

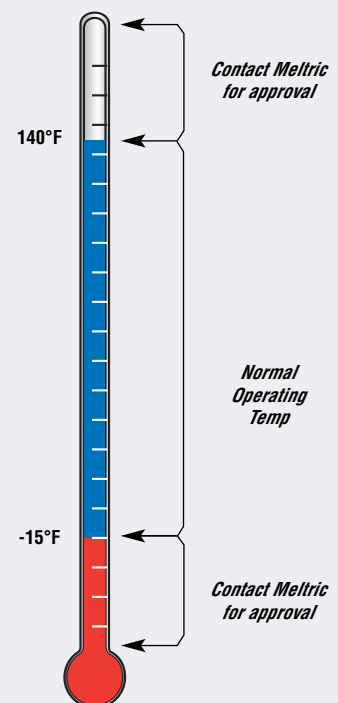
All Meltric plugs and receptacles can be used with no particular precaution from -15°F to 140°F/-26°C to 60°C.

## Hot Temperatures

Some devices that do not contain any polyamide can operate up to 175°F/80°C but precise conditions and duty cycles must be submitted to the Meltric engineering department for approval. A limited range of products are available for ambient temperatures up to 365°F/185°C. Contact Meltric customer service for more information.

## Cold Temperatures

Below -15°F materials become more brittle and impact should be avoided, especially on polyamide materials. However, Meltric's metal and polyester casings can be used as low as -40°F/-40°C and some Meltric devices are in service at -75°F/-60°C. Consult factory for more information.



# Color Coded Gaskets & Labels

## For Voltage Identification

| PIN CONFIGURATION | VOLTAGE  | FREQUENCY | 5 <sup>th</sup> , 6 <sup>th</sup> and 7 <sup>th</sup> PART NUMBER DIGITS | RECEPTACLE/CONNECTOR |                 | PLUG/INLET   |                 |
|-------------------|----------|-----------|--|----------------------|-----------------|--------------|-----------------|
|                   |          |           |  | COLOR GASKET         | VOLTAGE STICKER | COLOR GASKET | VOLTAGE STICKER |
| 1P+N+E            | 110/130V | 50Hz      | 035  | YELLOW               | YELLOW          | YELLOW       | YELLOW          |
|                   | 115/127V | 200Hz     | 125  | GREEN                | YELLOW          | GREEN        | YELLOW          |
|                   | 115/127V | 400Hz     | 115  | GREEN                | YELLOW          | GREEN        | YELLOW          |
|                   | 120/127V | 60Hz      | 165  | YELLOW               | YELLOW          | YELLOW       | YELLOW          |
|                   | 110/125V | 60Hz      | 075  | ORANGE               | ORANGE          | ORANGE       | ORANGE          |
|                   | 220/250V | 50Hz      | 015  | BLUE                 | BLUE            | BLUE         | BLUE            |
|                   | 255/277V | 60Hz      | 045  | GREY                 | GREY            | GREY         | GREY            |
|                   | 347V     | 60Hz      | 145  | RED                  | RED             | RED          | RED             |
|                   | 380/440V | 50Hz      | 195  | RED                  | RED             | RED          | RED             |
|                   | 577V     | 50Hz      | 225  | BLACK                | BLACK           | BLACK        | BLACK           |
| 2P                | 20/24V   | 50Hz      | 08A  | VIOLET               | VIOLET          | VIOLET       | VIOLET          |
|                   | 20/24V   | 60Hz      | 02A  | VIOLET               | VIOLET          | VIOLET       | VIOLET          |
|                   | 20/24V   | DC        | 08Z  | VIOLET               | VIOLET          | VIOLET       | VIOLET          |
|                   | 25/28V   | 50Hz      | 06A  | SKY BLUE             | SKY BLUE        | SKY BLUE     | SKY BLUE        |
|                   | 25/28V   | DC        | 06Z  | SKY BLUE             | SKY BLUE        | SKY BLUE     | SKY BLUE        |
|                   | 40/48V   | DC        | 13Z  | WHITE                | WHITE           | WHITE        | WHITE           |
|                   | 40/48V   | 50Hz      | 13A  | WHITE                | WHITE           | WHITE        | WHITE           |
| 2P+E              | 110/130V | DC        | 109  | YELLOW               | YELLOW          | YELLOW       | YELLOW          |
|                   | 200/220V | 200Hz     | 122  | GREEN                | BLUE            | GREEN        | BLUE            |
|                   | 200/220V | 400Hz     | 112  | GREEN                | BLUE            | GREEN        | BLUE            |
|                   | 208/220V | 60Hz      | 162  | BLUE                 | BLUE            | BLUE         | BLUE            |
|                   | 220/250V | 50Hz      | 032  | BLUE                 | BLUE            | BLUE         | BLUE            |
|                   | 220/250V | DC        | 209  | BLUE                 | BLUE            | BLUE         | BLUE            |
|                   | 220/250V | 60Hz      | 072  | ORANGE               | ORANGE          | ORANGE       | ORANGE          |
|                   | 380/440V | 50Hz      | 012  | RED                  | RED             | RED          | RED             |
|                   | 440/480V | 60Hz      | 042  | RED                  | RED             | RED          | RED             |
|                   | 480/500V | 50Hz      | 092  | BLACK                | BLACK           | BLACK        | BLACK           |
|                   | 600V     | 60Hz      | 142  | BLACK                | BLACK           | BLACK        | BLACK           |
|                   | 660/690V | 50Hz      | 192  | BLACK                | BLACK           | BLACK        | BLACK           |
|                   | 1000V    | 50Hz      | 222  | BLACK                | BLACK           | BLACK        | BLACK           |

| PIN CONFIGURATION | VOLTAGE                  | FREQUENCY | 5 <sup>th</sup> , 6 <sup>th</sup> and 7 <sup>th</sup> PART NUMBER DIGITS | RECEPTACLE/CONNECTOR |                 | PLUG/INLET   |                 |
|-------------------|--------------------------|-----------|--|----------------------|-----------------|--------------|-----------------|
|                   |                          |           |  | COLOR GASKET         | VOLTAGE STICKER | COLOR GASKET | VOLTAGE STICKER |
| 2P+N+E            | 115 / 127V<br>200 / 220V | 200Hz     | 126  | GREEN                | YELLOW<br>BLUE  | GREEN        | YELLOW<br>BLUE  |
|                   | 115 / 127V<br>200 / 220V | 400Hz     | 116  | GREEN                | YELLOW<br>BLUE  | GREEN        | YELLOW<br>BLUE  |
|                   | 120 / 127V<br>208 / 220V | 60Hz      | 166  | BLUE                 | YELLOW<br>BLUE  | BLUE         | YELLOW<br>BLUE  |
|                   | 110 / 130V<br>190 / 230V | 50Hz      | 036  | BLUE                 | YELLOW<br>BLUE  | BLUE         | YELLOW<br>BLUE  |
|                   | 110 / 125V<br>220 / 250V | 60Hz      | 076  | ORANGE               | ORANGE          | ORANGE       | ORANGE          |
|                   | 220 / 250V<br>380 / 440V | 50Hz      | 016  | RED                  | BLUE<br>RED     | RED          | BLUE<br>RED     |
|                   | 255 / 277V<br>440 / 480V | 60Hz      | 046  | RED                  | RED             | RED          | RED             |
|                   | 480/500V                 | 50Hz      | 096  | BLACK                | BLACK           | BLACK        | BLACK           |
|                   | 347/600V                 | 60Hz      | 146  | BLACK                | RED<br>BLACK    | BLACK        | RED<br>BLACK    |
|                   | 380 / 400V<br>660 / 690V | 50Hz      | 196  | BLACK                | RED<br>BLACK    | BLACK        | RED<br>BLACK    |
| 3P+E              | 200/220V                 | 200Hz     | 123  | GREEN                | BLUE            | GREEN        | BLUE            |
|                   | 200/220V                 | 400Hz     | 113  | GREEN                | BLUE            | GREEN        | BLUE            |
|                   | 208/220V                 | 60Hz      | 163  | BLUE                 | BLUE            | BLUE         | BLUE            |
|                   | 220/250V                 | 50Hz      | 033  | BLUE                 | BLUE            | BLUE         | BLUE            |
|                   | 220/250V                 | 60Hz      | 073  | ORANGE               | ORANGE          | ORANGE       | ORANGE          |
|                   | 380/440V                 | 50Hz      | 013  | RED                  | RED             | RED          | RED             |
|                   | 440/480V                 | 60Hz      | 043  | RED                  | RED             | RED          | RED             |
|                   | 480/500V                 | 50Hz      | 093  | BLACK                | BLACK           | BLACK        | BLACK           |
|                   | 600V                     | 60Hz      | 143  | BLACK                | BLACK           | BLACK        | BLACK           |
|                   | 660/690V                 | 50Hz      | 193  | BLACK                | BLACK           | BLACK        | BLACK           |
| 1000V             | 50Hz                     | 223       | BLACK  | BLACK                | BLACK           | BLACK        |                 |
| 3P+N+E            | 110 / 130V<br>220 / 250V | 50Hz      | 037  | BLUE                 | YELLOW<br>BLUE  | BLUE         | YELLOW<br>BLUE  |
|                   | 115 / 127V<br>200 / 220V | 200Hz     | 127  | GREEN                | YELLOW<br>BLUE  | GREEN        | YELLOW<br>BLUE  |
|                   | 115 / 127V<br>200 / 220V | 400Hz     | 117  | GREEN                | YELLOW<br>BLUE  | GREEN        | YELLOW<br>BLUE  |
|                   | 120 / 127V<br>208 / 220V | 60Hz      | 167  | BLUE                 | YELLOW<br>BLUE  | BLUE         | YELLOW<br>BLUE  |
|                   | 110 / 125V<br>220 / 250V | 60Hz      | 077  | ORANGE               | ORANGE          | ORANGE       | ORANGE          |
|                   | 220 / 250V<br>380 / 440V | 50Hz      | 017  | RED                  | BLUE<br>RED     | RED          | BLUE<br>RED     |
|                   | 255 / 277V<br>440 / 480V | 60Hz      | 047  | RED                  | RED             | RED          | RED             |
|                   | 347/600V                 | 60Hz      | 147  | BLACK                | RED<br>BLACK    | BLACK        | RED<br>BLACK    |
|                   | 380 / 400V<br>660 / 690V | 50Hz      | 197  | BLACK                | RED<br>BLACK    | BLACK        | RED<br>BLACK    |
|                   | MULTIPIN                 |           | NOT SPECIFIED  |                      | SKY BLUE        | SKY BLUE     | SKY BLUE        |