INTRODUCTION

Purpose:
To teach the customer about power switches and all their features and functions, and to display the variety of power switches E-Switch offers.

Objectives:
• What defines a power switch
• Resistive and inductive loads
• Most common poles and throws
• Environmental ratings and agency approvals
• Illumination and termination options
• Temperature range and life cycles
• Summary of our most common power switches
WHAT IS A POWER SWITCH?

Definition: A switch with a range between 48 and 277 volts.

Three Power Levels

• Low Power: Switching less than 2 amps at rated voltage

• Medium Power: Switching above 2 amps and less than 10 amps at rated voltage

• High Power: Switching above 10 amps at rated voltage
POWER SWITCH LISTING BY CATEGORY

- Pushbutton
- Rocker
- Rotary
- Slide
- Snap Action
- Toggle
- Trigger
LOADS

Resistive Loads

Inductive Loads (Inrush)
POLES AND THROWS

Most common functions

- **SPST**
  - Single Pole, Single Throw

- **SPDT**
  - Single Pole, Double Throw

- **DPST**
  - Double Pole, Single Throw

- **DPDT**
  - Double Pole, Double Throw
**Single Pole Single Throw (SPST)**

**Example: On-Off (SPST)**

- When the switch is actuated, the circuit is complete, and the bulb will turn on.

![Flashlight](image)
Single Pole Double Throw (SPDT)

Example: On-Off-On (SPDT)
• The user decides what power setting to turn the vacuum to, either low or high.
Double Pole Single Throw (DPST)

Example: On-Off (DPST)
- When the switch turns the unit on, both the fan and the chiller are turned on at the same time.
Example: On-Off (DPDT)

- When the unit is turned on, both the fan and the heater are turned on at the same time. The user will decide if they want it on low or high fan with low or high heat.
ENVIRONMENTAL RATINGS

IP Ratings (*typically refer to components*)
- Common IP ratings for switches
  - IP40 – Most switches fall within this rating, where there is protection from solid objects larger than 1mm
  - IP54 – Typically referred to as weather resistant, meaning it is resistant to rain, but not a soaking with a hose
  - IP65 – Same as above, but can protect against a water hose
  - IP66 – Protected against strong jets of water
  - IP67 – Protected against temporary water immersion in less than 1 meter deep
  - IP68 – Protected against long periods of immersion under pressure

NEMA Ratings (*typically refer to enclosures*)
# IP Ratings Chart

<table>
<thead>
<tr>
<th>First Number</th>
<th>Definition</th>
<th>Second Number</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Protection against solid objects)</td>
<td>(Protection against liquids)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>No protection</td>
<td>0</td>
<td>No protection</td>
</tr>
<tr>
<td>1</td>
<td>Protected against solid objects over 50mm (e.g. accidental touch by hands)</td>
<td>1</td>
<td>Protected against vertically falling drops of water</td>
</tr>
<tr>
<td>2</td>
<td>Protected against solid objects over 12mm (e.g. fingers)</td>
<td>2</td>
<td>Protected against direct sprays up to 15° from the vertical</td>
</tr>
<tr>
<td>3</td>
<td>Protected against solid objects over 2.5mm (e.g. tools and wires)</td>
<td>3</td>
<td>Protected against direct sprays up to 60° from vertical</td>
</tr>
<tr>
<td>4</td>
<td>Protected against solid objects over 1mm (e.g. tools and small wires)</td>
<td>4</td>
<td>Protected against sprays from all directions – limited ingress permitted</td>
</tr>
<tr>
<td>5</td>
<td>Protected against dust – limited ingress (no harmful deposit)</td>
<td>5</td>
<td>Protected against low pressure jets of water from all directions – limited ingress permitted</td>
</tr>
<tr>
<td>6</td>
<td>Totally protected against dust</td>
<td>6</td>
<td>Protected against strong jets of water (e.g. for use on shipdecks – limited ingress permitted)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Protected against the effects of temporary immersion between 15cm and 1m. Duration of test 30 min.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>Protected against long periods of immersion under pressure</td>
</tr>
<tr>
<td>Enclosure Type</td>
<td>Location of Use</td>
<td>Short Definition</td>
<td>IP Equivalent</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>1</td>
<td>Indoor</td>
<td>Protects against modest amounts of falling dirt. Mostly protects safety of user.</td>
<td>IP10</td>
</tr>
<tr>
<td>2</td>
<td>Indoor</td>
<td>Protects against drips of water/dirt</td>
<td>IP11</td>
</tr>
<tr>
<td>3</td>
<td>Indoor / Outdoor</td>
<td>Protects against weather elements</td>
<td>IP54</td>
</tr>
<tr>
<td>3R</td>
<td>Indoor / Outdoor</td>
<td>Protects against weather elements except dust particles</td>
<td>IP14</td>
</tr>
<tr>
<td>3S</td>
<td>Indoor / Outdoor</td>
<td>Protects against weather elements; external mechanisms are operable when iced</td>
<td>IP54</td>
</tr>
<tr>
<td>4</td>
<td>Indoor / Outdoor</td>
<td>Protects against weather elements and water hosing</td>
<td>IP56</td>
</tr>
<tr>
<td>4X</td>
<td>Indoor / Outdoor</td>
<td>Protects against weather elements, water hosing and is corrosion resistant</td>
<td>IP56</td>
</tr>
<tr>
<td>5</td>
<td>Indoor</td>
<td>Protects against settling dust particles, falling dirt and dripping non-corrosive liquids</td>
<td>IP52</td>
</tr>
<tr>
<td>6</td>
<td>Indoor / Outdoor</td>
<td>Protects against weather elements, water hosing and temporary submersion</td>
<td>IP67</td>
</tr>
<tr>
<td>6P</td>
<td>Indoor / Outdoor</td>
<td>Protects against weather elements, water hosing and prolonged submersion</td>
<td>IP67</td>
</tr>
<tr>
<td>12 and 12K</td>
<td>Indoor</td>
<td>Protects against circulating dust particles, falling dirt and non-corrosive dripping liquids</td>
<td>IP52</td>
</tr>
<tr>
<td>13</td>
<td>Indoor</td>
<td>Protects against dust particles, water hosing, oil and non-corrosive liquids</td>
<td>IP54</td>
</tr>
</tbody>
</table>
ILLUMINATION CLASSES

Three Classes of Illumination

1. Independent
2. Dependent
3. Semi-independent
1. **Independent Illumination**: Where the switch and light are electrically connected, independent from each other.
2. **Dependent Illumination**: Where the switch and light are electrically connected and dependent on each other.
3. **Semi-independent**: Where the switch and light share a common electrical terminal. The customer can decide if the switch and illumination are wired independent or dependent on each other.
Possible Lamp Styles

- Neon lamp is rated at AC Voltage
- Incandescent and LED lamps are normally rated at DC voltage
Possible Panel Mount Termination Options

- Typical panel thickness range is 1.5mm-4mm
- Standard panel cutout sizes (mm)
  - Rectangular: 11x30, 13x19, 22x30
  - Circular: 16, 20, 22, 25
PC BOARD MOUNT OPTIONS

Possible PCB Terminations

- All products are RoHS and lead-free soldering process compatible
Typically required on switches above 48 volts

Country specific, so make sure you have the right approval for the country the final product will be sold in
TEMPERATURE RATINGS

- Most common temperature range
  - -30°C to 85°C

You can get any temperature tested, so if you need a higher temperature for your project, UL, VDE, ENEC, etc can test to your specified temperature.
LIFE CYCLES

• Power switches will typically have 2 ratings
  – Electrical
    • Range from 6,000 to 100,000
  – Mechanical
    • Range from 20,000 to 100,000

• UL and ENEC test switches to specific life cycles
  – UL starts testing at 6,000 cycles
  – ENEC starts testing at 10,000 cycles
ROTARY SUMMARY LISTING

- 4RH 25A 250VAC
- X02 10A 125VAC
SLIDE SUMMARY LISTING

500
5A 120VAC

500A
3A 120VAC

LSU
11A 125VAC
TOGGLE SUMMARY LISTING

100
5A 120VAC

100A
5A 120VAC

200
3A 120VAC

200A
3A 120VAC

ST1
20A 125VAC

ST2
20A 125VAC

ST3
24A 125VAC
TRIGGER SUMMARY LISTING

HY37
17A 125VAC
SUMMARY

Today we learned:

• What a power switch is and the most popular types of power switches
• What the most common functions of a power switch are
• About agency approvals and environmental ratings
• Types of illumination and lamp styles available
• Termination options for power switches
• Typical ratings and common temperature ranges
• About the power switches E-Switch has available.