

# ISO 9001/UL/CUL/EU/RoHS

Throughout the world, there is a wide variety of regulatory codes, agency approvals, and other types of certification that may be required in order to install an automation system. These requirements vary and depend on your exact location and situation. For example, there may be national codes, state and local government codes, and even wide-ranging requirements such as the European Union (EU) Directives. The following are some of these codes and requirements, and explanations of how they may affect you as a PLC and industrial controls user.

## ISO 9001

Some companies require their suppliers to use products that are built by companies that adhere to a documented set of quality-related procedures. ISO 9001 is one of the standards in the ISO 9000 family of standards for quality management systems. Koyo Electronics Industries Company, Ltd., the manufacturer of most of our PLC products, is an ISO 9001 certified company, as are many of our other Federation members.

## Underwriters Laboratories (UL/CUL)

Underwriters Laboratories is one of the world's premier safety testing and certification sources. Many applications require UL approval for insurance and/or other compliance purposes. There are several areas of interest, but the most applicable are: UL508, the standard for Industrial Control Equipment; and UL1604, the standard covering Hazardous Locations. For more information on the Underwriters Laboratories, check their Web site at [www.ul.com](http://www.ul.com). There are several tables in this section that show which of our products have a UL listing. (They also indicate the cUL approval, which is required in many applications in Canada.) Please check our Web site for the most current information.

## European Union (EU) Directives

This area of certification and approval is absolutely vital to anyone who wants to do business in Europe. One of the key tasks that faced the EU member countries and the European Economic Area (EEA) was the requirement to bring several similar, yet distinct, standards together into one common standard for all members. The primary purpose of a single standard was to make it easier to sell and transport goods between the various countries and to maintain a safe working and living environment. The Directives that resulted from this "harmonization" of standards are now legal requirements for doing business in Europe. Products that meet these Directives are required to have a CE mark to signify compliance. A few key questions are always asked when the

subject of CE is discussed.

**Which Directives apply to me?** Several Directives apply to our products, and Directives may be amended or added, as required.

- **Electromagnetic Compatibility Directive (EMC)** – Provides a means to ensure that products placed on the market do not generate electromagnetic disturbances that would affect other apparatus, including radio and/or telecommunications equipment.
- **Machinery Safety Directive** – Covers the safety aspects of the equipment, installation, etc. There are several areas involved, including testing standards covering both electrical noise immunity and noise generation.
- **Low Voltage Directive** – Is also safety related and covers electrical equipment that has voltage ranges of 50-1,000 VAC and/or 75-1,500 VDC.
- **Battery Directive** – Covers the production, recycling, and disposal of batteries.

## Who is responsible for ensuring compliance with these Directives?

Ultimately, we are all responsible for our various pieces of the puzzle. Manufacturers must test their products and document any test results and/or installation procedures necessary to comply with the Directives. As a machine builder, you are responsible for installing the products in a manner that will ensure compliance is maintained. You are also responsible for testing any combinations of products that may (or may not) comply with the Directives when used together. The end user of the products must comply with any Directives that may cover maintenance, disposal, etc., of equipment or various components. Although we strive to provide the best assistance available, it is impossible for us to test all possible configurations of the products we carry with respect to any specific Directive. Because of this, it is ultimately your responsibility to ensure that your machinery (as a whole) complies with these Directives and to keep up with applicable Directives and/or practices that are required for compliance.

**Which programmable controller products carry the CE label?** See Tables in our Agency Approval list (<https://cdn.automationdirect.com/static/specs/agencyapprovals.pdf>) for controller systems manufactured by Koyo Electronics Industries, Host Engineering or FACTS Engineering. When properly installed and used, the approved components conform to the Electromagnetic Compatibility (EMC), Low Voltage Directive, and Machinery Directive requirements of the standards on the next page.

## EC 61000-3-2 Power Factor Correction

The IEC 61000-3-2 standard is intended to reduce the amount of disturbance a device feeds back into its power source.

AutomationDirect power supplies all carry the CE mark. Normally, 61000-3-2 is met or does not apply. Only our PS24-150D and PS24-300D could potentially be used in a manner not compliant with the 61000-3-2 standard.

## RoHS 2

The RoHS Recast Directive (RoHS 2) was published in the Official Journal on 1 July 2011. Formally called Restriction of the Use of Certain Hazardous Substances Directive 2011/65/EC (RoHS 2) it restricts the use of six hazardous materials in the manufacture of various types of electrical and electronic equipment. RoHS 2 is linked with the Waste Electrical and Electronic Equipment Directive (WEEE Directive 2012/19/EU entered into force on 13 August 2012 and became effective on 14 February 2014), which sets collection, recycling and recovery targets for electrical goods and is part of a legislative initiative to solve the problem of large amounts of toxic e-waste.

Each EU member state will adopt its own enforcement and implementation policies using the directive as a guide. Therefore, there could be as many different versions of the directive as there are states in the EU.

RoHS 2 restricts the use of the following six substances:

- Lead
- Mercury
- Cadmium
- Hexavalent chromium (chromium VI or Cr 6+)
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ether (PBDE)

RoHS 3 (2015/863/EU amends RoHS 2 and adds four additional restricted substances:

- Bis(2-ethylhexyl) phthalate (DEHP) (0,1 %)
- Butyl benzyl phthalate (BBP) (0,1 %)
- Dibutyl phthalate (DBP) (0,1 %)
- Diisobutyl phthalate (DIBP) (0,1 %)

For a listing of all products and their compliance status see:

[http://support.automationdirect.com/docs/eu\\_rohs.pdf](http://support.automationdirect.com/docs/eu_rohs.pdf)

# EU - European Union

## • EMC Directive Standards Relevant to PLCs

- EN50081-1 – Generic emission standard for residential, commercial, and light industry
- EN50081-2 – Generic emission standard for industrial environment
- EN50082-1 – Generic immunity standard for residential, commercial, and light industry
- EN50082-2 – Generic immunity standard for industrial environment

## • Low Voltage Directive Standards Applicable to PLCs

- EN61010-1 – Safety requirements for electrical equipment for measurement, control, and laboratory use

## • Product Specific Standard for PLCs

- EN61131-2 – Programmable controllers, equipment requirements and tests. This standard replaces the above generic standards for immunity and safety. However, the generic emissions standards must still be used in conjunction with the following standards:
- EN 61000-3-2 – Harmonics
- EN 61000-3-2 – Fluctuations. We are currently in the process of changing our testing procedures from the generic standards to the product specific standards.

We do have separate Declarations of Conformity that cover the specific products and part numbers approved. Not all of the products have been labeled for CE as of this writing, so you should check the tables in our Agency Approval list (<https://cdn.automationdirect.com/static/specs/agencyapprovals.pdf>) to be sure. Please also check our Web site for the most up-to-date information on CE approvals or to obtain copies of our Declarations of Conformity.

### Are there any special requirements necessary when using controller equipment?

Yes, the installation requirements to comply with the requirements of the Machinery Directive, EMC Directive and Low Voltage Directive are slightly more complex than the normal installation requirements found in the United States. First, check the Declaration for specific application conditions required.

Finally, check your user manual for EU information.

### Are there any other sources of information?

Although the EMC Directive gets the most attention, other basic Directives, such as the Machinery Directive and the Low Voltage Directive, also place restrictions on the control panel builder. Because of these additional requirements, it is recommended that the following publications be purchased and used as guidelines:

- BSI publication TH42073: February 1996 – Covers the safety and electrical aspects of the Machinery Directive
- EN60204-1:1992 – General electrical requirements for machinery, including Low Voltage and EMC considerations
- IEC 1000-5-2: EMC earthing and cabling requirements
- IEC 1000-5-1: EMC general considerations

It may be possible for you to obtain this information locally. However, the official source of applicable Directives and related standards is:

### The Office for Official Publications of the European Communities at [www.europa.eu.int](http://www.europa.eu.int)

Another source is:

### Global Engineering Documents

15 Inverness Way East

Englewood, CO 80112-5776

1(800) 854-7179 (within the U.S.)

(303) 397-7956 (international)

(303) 397-2740 (fax)

[www.global.ihs.com](http://www.global.ihs.com)

The information contained in this section is intended as a guideline and is based on our interpretation of the various standards and requirements. Since the actual standards are issued by other parties and in some cases Governmental agencies, the requirements can change over time without advance warning or notice. Changes or additions to the standards can possibly invalidate any part of the information provided in this section.

## Books

Following is a list of books that may be helpful to you:

### Title: EMC For Systems and Installations

Authors: Tim Williams and Keith Armstrong  
 Publisher: Newnes  
 Woburn, MA

### Title: CE From A to Z

Authors: Mette Winther Pedersen & Gert Bukkjaer  
 Publisher: Levison & Johnson & Johnson a/s  
 Denmark

### Title: EU Directive Handbook: Understanding the European Union Compliance Process and What it Means to You

Authors: Allen R. Bailey & Melinda C. Bailey  
 Publisher: St. Lucie Press  
 Boca Raton, FL

### Title: Practical Guide to the Low Voltage Directive

Authors: Gregg Kervill  
 Publisher: Newnes  
 Woburn, MA

### Title: CE Marking Handbook: A Practical Approach to Global Safety Certification

Authors: David Lohbeck  
 Publisher: Newnes  
 Woburn, MA

# NEC and NEMA

## The National Electrical Code (NEC)

NEC provides regulations concerning the installation and use of various types of electrical equipment.

These classifications are being "harmonized" with the IEC and European Hazardous Location Ratings. A source of information about this "harmonization" is the Instrument Society of America (ISA).

Contact the ISA at:

67 Alexander Drive

RTP, NC 27709

Phone: (919)549-8411

[www.isa.org](http://www.isa.org)

Another resource is:

[www.ul.com/hazloc](http://www.ul.com/hazloc)

## National Electrical Manufacturers Association (NEMA)

NEMA publishes many different documents that discuss standards for industrial control equipment. Please note that these standards are undergoing "harmonization" with the IEC and European standards and may be replaced. Global Engineering Documents handles the sale of NEMA, IEC and CE documents. For more information, please contact Global Information at:

1 (800) 854-7179 (within the U.S.)

(303) 397-7956 (international)

(303) 397-2740 (fax)

15 Inverness Way East

Englewood, CO 80112-5776

[www.global.ihs.com](http://www.global.ihs.com)

- ICS 1, General Standards for Industrial Control and Systems
- ICS 2, Controllers, Contactors, and Overload Relays, Rated no more than 2000 Volts AC or 750 Volts DC
- ICS 3, Factory Built Assemblies
- ICS 6, Enclosures for Industrial Control Systems

National Electric Code (NEC) Article 500 Hazardous Location Classification			
Class	Division	Group	
<p><b>Class I</b> Locations in which flammable gases or vapors are (or may be) present in the air in quantities great enough to produce explosive or ignitable mixtures.</p>	<p><b>DIVISION 1:</b> Locations in which hazardous concentrations of flammable gases or vapors exist continuously, intermittently, or periodically under normal conditions.                      -or- Locations in which hazardous concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage.                      -or- Locations in which breakdown or faulty operation of equipment or processes might release hazardous concentrations of flammable gases or vapors.  <b>DIVISION 2:</b> Locations in which volatile flammable liquids or flammable gases are handled, processed, or used, but are normally kept in closed containers and can only escape due to accidental rupture.                      -or- Locations in which hazardous concentrations of gases or vapors are normally prevented by mechanical ventilation and might become hazardous due to failure of the ventilating equipment.                      -or- Locations that are adjacent to Class I, Division 1 locations.</p>	<p><b>GROUP A:</b> Atmospheres containing acetylene  <b>GROUP B:</b> Atmospheres containing:                      acrolein(inhibited)                      butadiene                      ethylene oxide                      hydrogen                      gases containing more than 30% hydrogen by volume                      propylene oxide  <b>GROUP C:</b> Atmospheres containing:                      allyl alcohol                      carbon monoxide                      cyclopropane                      diethyl ether                      ethylene                      hydrogen sulfide                      methyl ether                      n-propyl ether                      or gases or vapors of equivalent hazard</p>	<p><b>GROUP D:</b> Atmospheres containing:                      acetone                      ammonia                      benzene                      butyl alcohol                      ethane                      ethyl alcohol                      gasoline                      heptanes                      hexanes                      methane (natural gas)                      methyl alcohol                      methyl ethyl ketone (MEK)                      naphta                      octanes                      pentanes                      propane                      styrene                      toluene                      xylenes                      or gases or vapors of equivalent hazard</p>
<p><b>Class II</b> Locations in which there are explosive mixtures of air and combustible dust.</p>	<p><b>DIVISION 1:</b> Locations in which explosive or ignitable amounts of combustible dust are or may be in suspension of continuously, intermittently, or periodically under normal operating conditions.                      -or- Locations where mechanical failure or abnormal operation of machinery or equipment might cause explosive or ignitable mixtures to be produced.                      -or- Locations in which combustible electrically conductive dust is present.  <b>DIVISION 2:</b> Locations where combustible dust deposits exist but are not likely to be thrown into suspension in the air, but where the dust deposits may be heavy enough to interfere with safe heat dissipation from electrical equipment.                      -or- Locations where combustible dust deposits may be ignited by arcs, sparks, or burning material from electrical equipment.</p>	<p><b>GROUP E:</b> Atmospheres containing combustible: metal dusts regardless of resistivity or dusts of similarly hazardous characteristics having resistivity of less than 100,000 ohm-centimeter  <b>GROUP F:</b> Atmospheres containing combustible: carbon black, charcoal, or coke dusts which have more than 8% total volatile material or- carbon black, charcoal, or coke dusts sensitized by other materials so that they present an explosion hazard, and having a resistivity greater than 100 ohm-centimeter but equal to or less than 100,000,000 ohm-centimeter  <b>GROUP G:</b> Atmospheres containing dusts having resistivity of 100,000,000 ohm-centimeter</p>	
<p><b>Class III</b> Locations in which there is the presence of easily-ignited fibers or flyings, but where the fibers or flyings are not likely to be in suspension in the air in quantities great enough to produce ignitable mixtures.</p>	<p><b>DIVISION 1:</b> Locations in which easily ignitable fibers or materials producing flyings are handled, manufactured, or used.  <b>DIVISION 2:</b> Locations in which easily ignitable fibers are stored or handled (except in a manufacturing process).</p>	<p><b>(NOT GROUPED)</b> Manufacturers include: textile mills, clothing plants, and fiber processing plants.                      Easily ignitable fibers include: Cotton, rayon, sisal, hemp, and jute.</p>	

NEMA Electrical Enclosure Environmental Protection Ratings			
Type	Protection	Location	Description
1	General purpose	Indoor	Accidental contact
2	Drip-proof	Indoor	Falling non-corrosive liquids and falling dirt (dripping and light splashes)
3	Dust-tight, rain-tight	Outdoor	Windblown dust, water, and sleet; ice-resistant
3R	Dust-tight, rain-tight	Outdoor	Same as above, plus melting of sleet/ice will not damage external enclosure or mechanisms
4	Water-tight/dust-tight	Indoor/ outdoor	Splashing water, outdoor seepage of water, falling or hose-directed water
4X	Water-tight/dust-tight	Indoor/ outdoor	Same as above, plus corrosion resistant
5	Dust-tight	Indoor	Dust and falling dirt
6	Water-tight/dust-tight	Indoor/ outdoor	Temporary entry of water limited submersion, formation of ice on enclosure
6P	Water-tight/dust-tight	Indoor/ outdoor	Same as previous, plus prolonged submersion
7	Explosion proof/Class I Group D Hazardous Locations	Indoor	Hazardous chemicals and gases
9	Explosion proof/Class II Hazardous Locations	Indoor	Hazardous dust
11	Drip-proof/corrosion Resistant	Indoor	Oil immersion, corrosive effects of liquids and gases
12	Drip-tight/dust-tight	Indoor	Fibers, lint, dust, and splashing, and dripping condensation of non-corrosive liquids
13	Oil-tight/dust-tight	Indoor	Dust, spraying of water, oil, and non-corrosive coolant

# How to interpret IP Ratings

The first number defines the degree of protection against penetration of solid objects into the housing.

The second number defines the degree of protection against penetration of liquid into the housing.

## IP-67 (sample IP rating)

First Number	Level of Protection
<b>X</b>	Not evaluated
<b>0</b>	No protection against contact or entry of solids
<b>1</b>	Protection against accidental contact by hand, but not deliberate contact. Protection against large foreign objects. 1: >= 50mm 2: >= 12.5 mm 3: >= 2.5 mm 4: >= 1.0 mm
<b>2</b>	Protection against contact by fingers. Protection against medium-size foreign objects. 1: >= 50mm 2: >= 12.5 mm 3: >= 2.5 mm 4: >= 1.0 mm
<b>3</b>	Protection against contact by tools, wires, etc. Protection against small foreign objects.. 1: >= 50mm 2: >= 12.5 mm 3: >= 2.5 mm 4: >= 1.0 mm
<b>4</b>	Protection against contact by small tools and wires. Protection against small foreign objects.. 1: >= 50mm 2: >= 12.5 mm 3: >= 2.5 mm 4: >= 1.0 mm
<b>5</b>	Complete protection against contact with live or moving parts. Protection against harmful deposits of dust.
<b>6</b>	Complete protection from live or moving parts. Protection against penetration of dust.

Second Number	Level of Protection
<b>X</b>	Not evaluated
<b>0</b>	No Protection
<b>1</b>	Protection against drops of condensed water. Condensed water falling on housing shall have no effect.
<b>2</b>	Protection against drops of liquid. Drops of falling liquid shall have no effect when housing is tilted to 15° from vertical.
<b>3</b>	Protection against rain. No harmful effect from rain at angles less than 60° from vertical.
<b>4</b>	Protection against splashing from any direction.
<b>5</b>	Protection against water jets from any direction.
<b>6</b>	Protection against conditions on ships and decks. Water from heavy seas will not enter.
<b>7</b>	Protection against immersion in water. Water will not enter under stated conditions of pressure and length of time.
<b>8</b>	Protection against indefinite immersion in water under a specified pressure.
<b>8K</b>	Protection against indefinite immersion in water under a specified pressure.
<b>9</b>	Protection against indefinite immersion in water under a specified pressure.
<b>9K</b>	Protection against high-pressure/steam-jet cleaning.

Additional information on IP ratings can be found in the 1976 IEC Publication: Classification of Degrees of Protection Provided by Enclosures or at [www.iec.ch](http://www.iec.ch).  
Example: What is IP-67? Complete protection of live parts, protection against the penetration of dust. Additionally, protection while immersed in water.

# IEC Utilization Categories

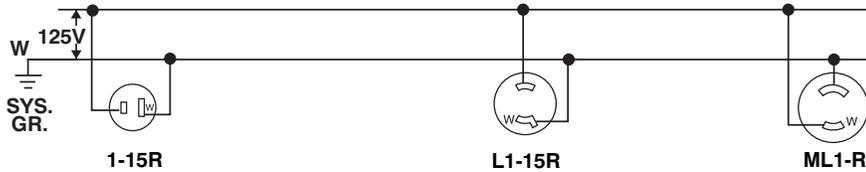
IEC Utilization Categories for Low Voltage Switchgear and Control Gear			
Current	Category	Typical Applications	Relevant IEC Product Standard
<b>AC</b>	AC-1	Non inductive or slightly inductive loads, resistance furnaces, heaters	<b>60947-4</b>
	AC-2	Slip-ring motors: switching off	
	AC-3	Squirrel-cage motors: starting, switching off motors during running most typical industrial application	
	AC-4	Squirrel-cage motors: starting, plugging (1), inching (2)	
	AC-5a	Switching of electric discharge lamps	
	AC-5b	Switching of incandescent lamps	
	AC-6a	Switching of transformers	
	AC-6b	Switching of capacitor banks	
	AC-7a	Slightly inductive load in household appliances: mixers, blenders	
	AC-7b	Motor-loads for household applications: fans, central vacuum	
	AC-8a	Hermetic refrigerant compressor motor control with manual resetting overloads	
	AC-8b	Hermetic refrigerant compressor motor control with automatic resetting overloads	
	AC-12	Control of resistive loads and solid state loads with opto-coupler isolation	
	AC-13	Control of solid state loads with transformer isolation	
	AC-14	Control of small electromagnetic loads	<b>60947-3</b>
	AC-15	Control of AC electromagnetic loads	
	AC-20	Connecting and disconnecting under no-load conditions	
	AC-21	Switching of resistive loads, including moderate loads	
AC-22	Switching of mixed resistive and inductive loads, including moderate overloads		
AC-23	Switching of motor loads or other highly inductive loads		
<b>AC and DC</b>	A	Protection of circuits, with no rated short-time withstand current	<b>60947-2</b>
	B	Protection of circuits, with a rated short-time withstand current	
<b>DC</b>	DC-1	Non-Inductive or slightly inductive loads, resistance furnaces, heaters	<b>60947-4</b>
	DC-3	Shunt-motors, starting, plugging (1), inching (2), dynamic breaking of motors	
	DC-5	Series-motors, starting, plugging (1), inching (2), dynamic breaking of motors	
	DC-6	Switching of incandescent lamps	
	DC-12	Control of resistive loads and solid state loads with opto-coupler isolation	
	DC-13	Control of DC electromagnetics	<b>60947-5</b>
	DC-14	Control of DC electromagnetic loads having economy resistors in the circuit	
	DC-20	Connecting and disconnecting under no-load conditions	
	DC-21	Switching of resistive loads, including moderate overloads	<b>60947-3</b>
	DC-22	Switching of mixed resistive and inductive loads, including moderate overloads (i.e., shunt motors)	
DC-23	Switching of highly inductive loads (i.e., series motors)		

# Wiring Devices – NEMA Wiring Diagrams

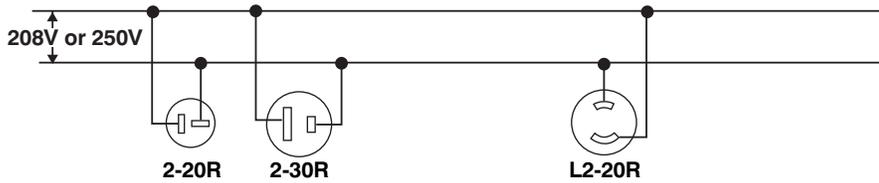
Reference material only. Please see Wiring Section in the catalog for product part number.

## 2-Pole 2-Wire

125V

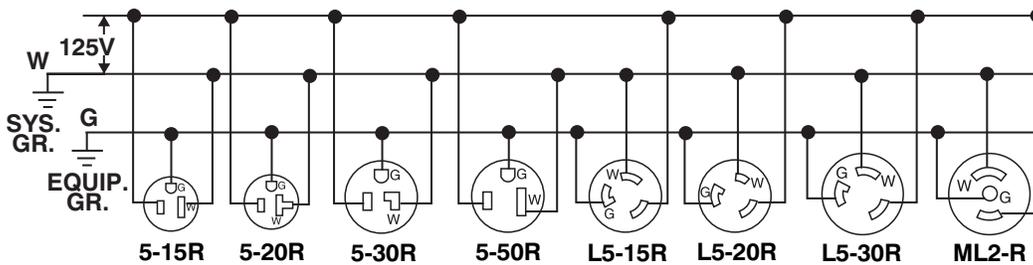


208V or 250V

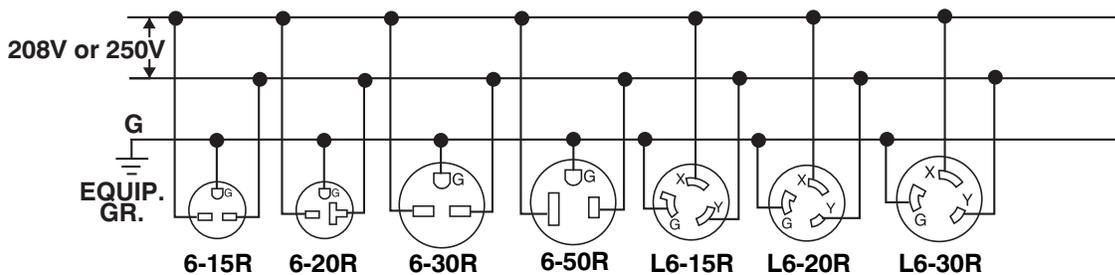


## 2-Pole 3-Wire Grounding

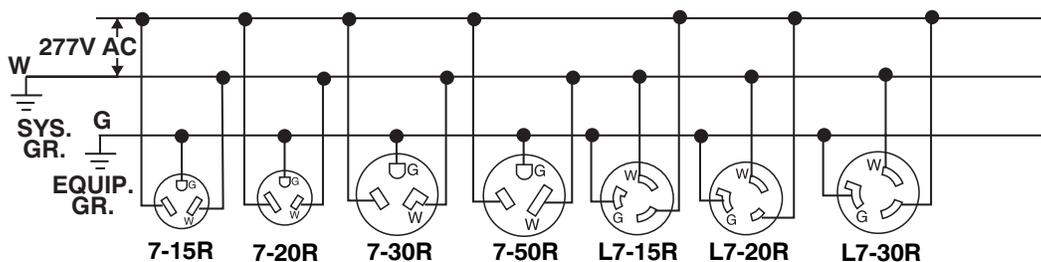
125V



208V or 250V

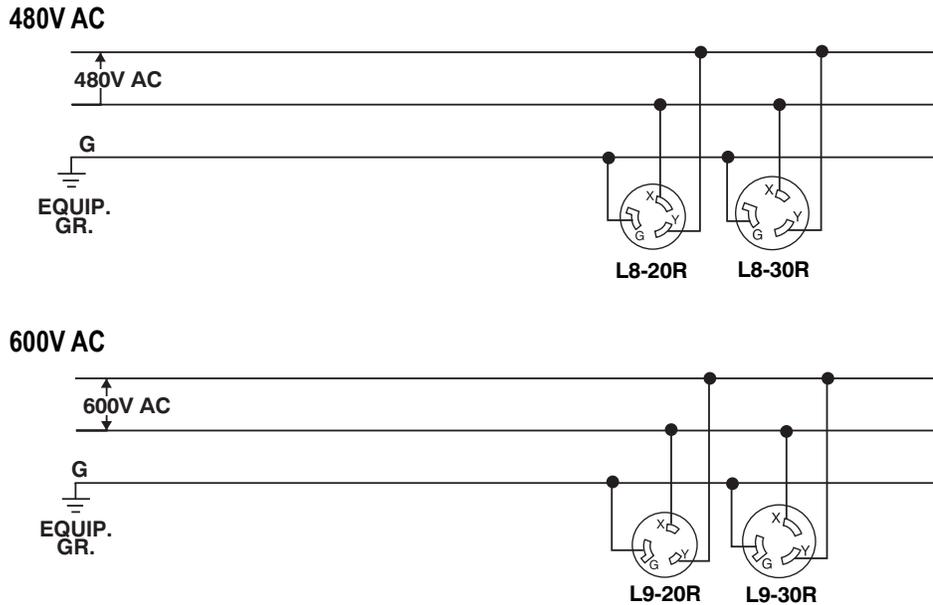


277V AC

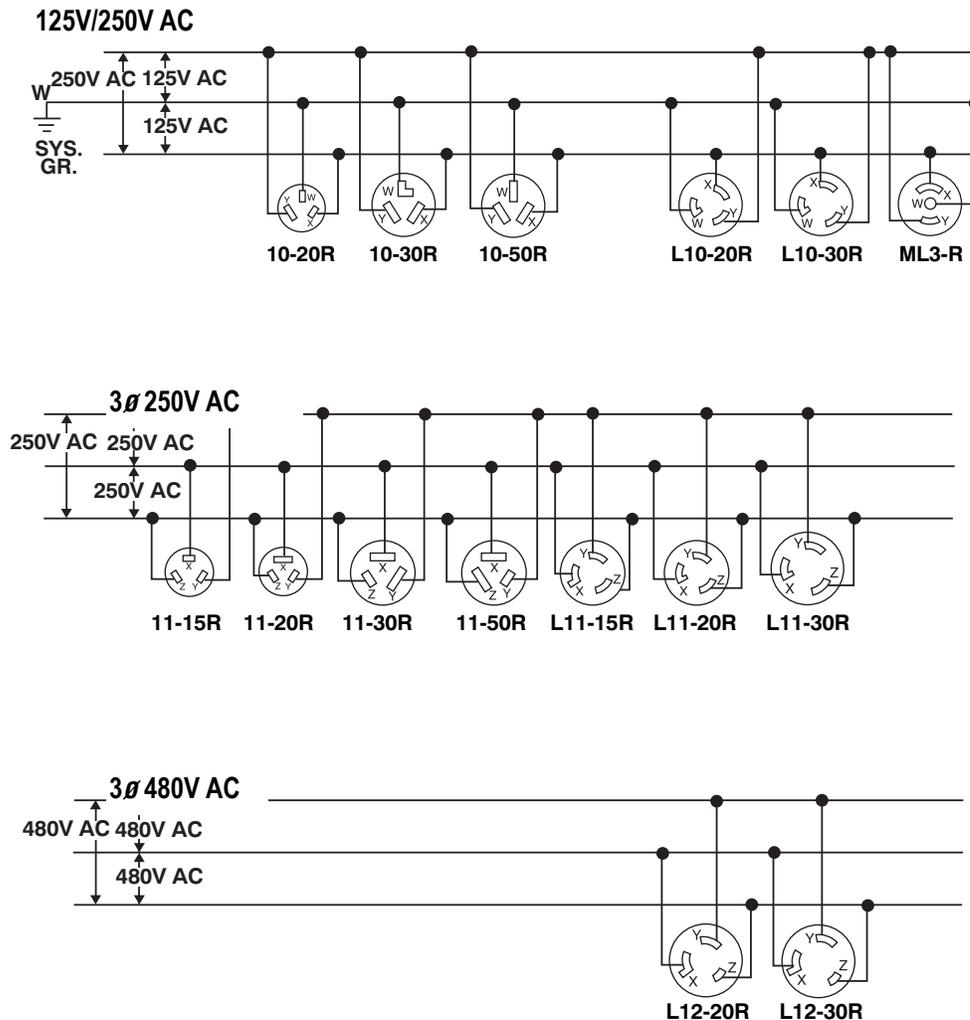


# Wiring Devices – NEMA Wiring Diagrams

## 2-Pole 3-Wire Grounding



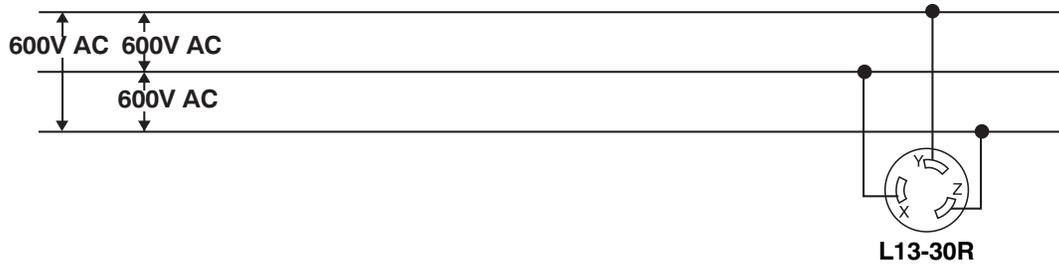
## 3-Pole 3-Wire



# Wiring Devices – NEMA Wiring Diagrams

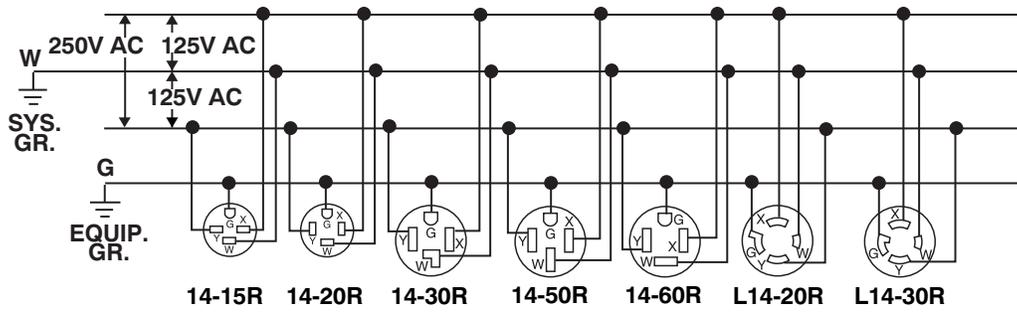
## 3-Pole 3-Wire Continued

3 $\phi$  600V AC

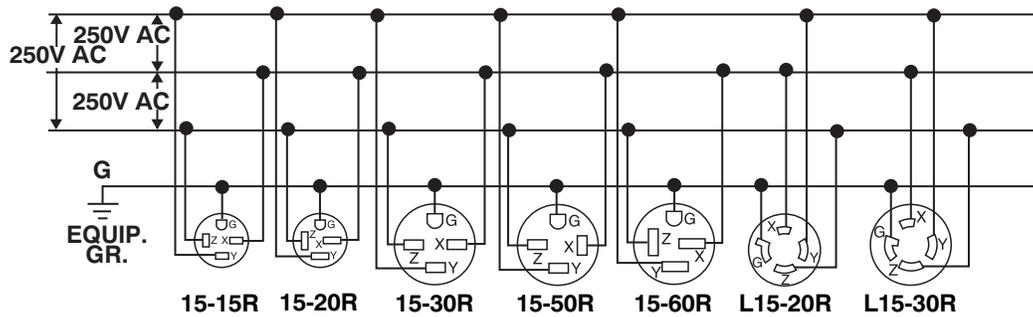


## 3-Pole 4-Wire Grounding

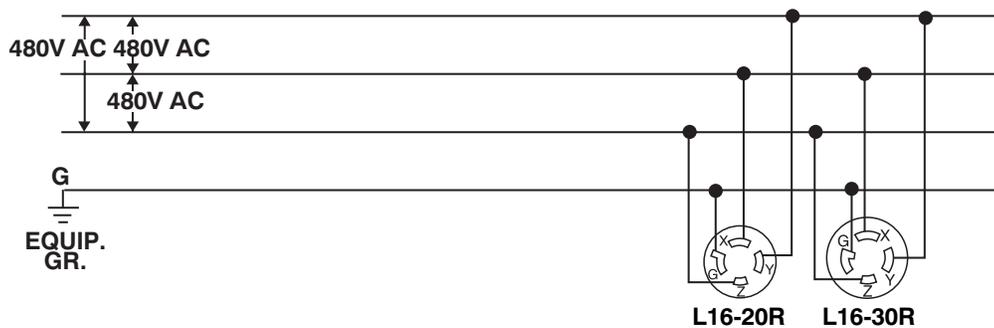
125/250V AC



3 $\phi$  250V AC



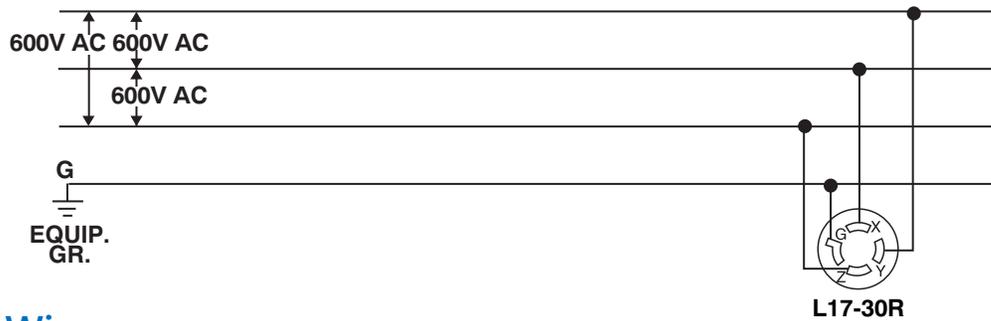
3 $\phi$  480V AC



# Wiring Devices – NEMA Wiring Diagrams

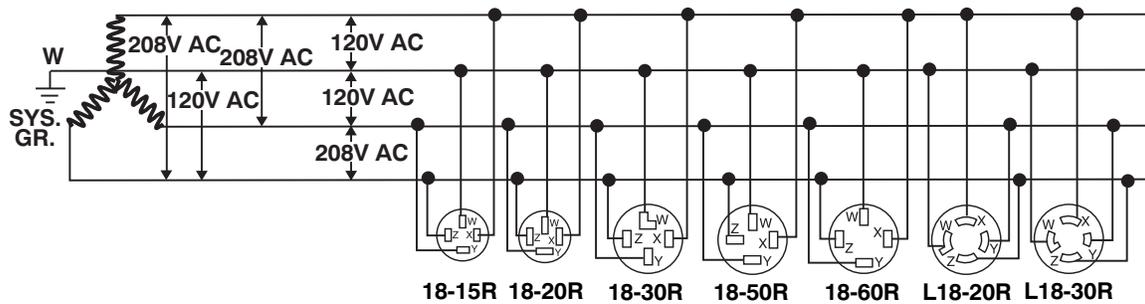
## 3-Pole 4-Wire Grounding Continued

**3 $\phi$  600V AC**

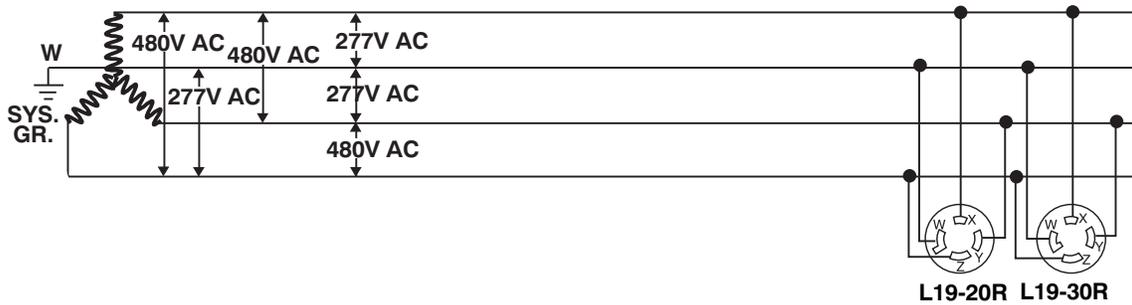


## 4-Pole 4-Wire

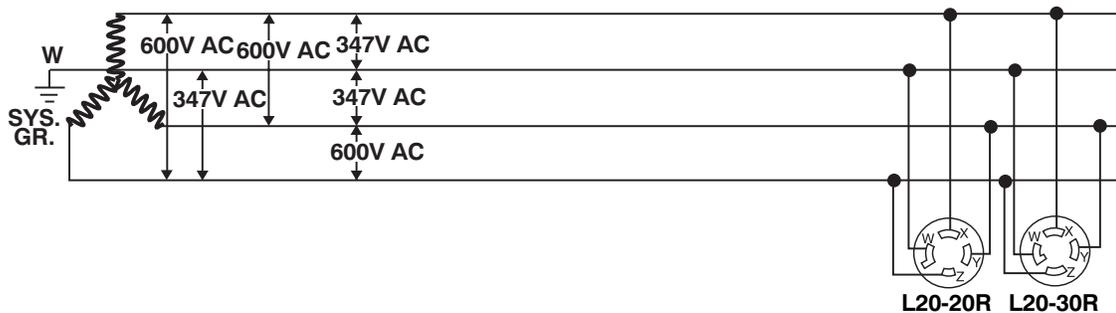
**3 $\phi$ Y 120/208V AC**



**3 $\phi$ Y 277/480V AC**



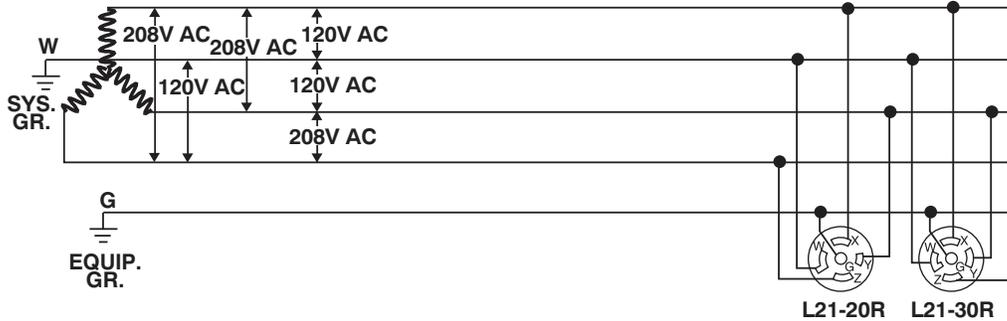
**3 $\phi$ Y 347/600V AC**



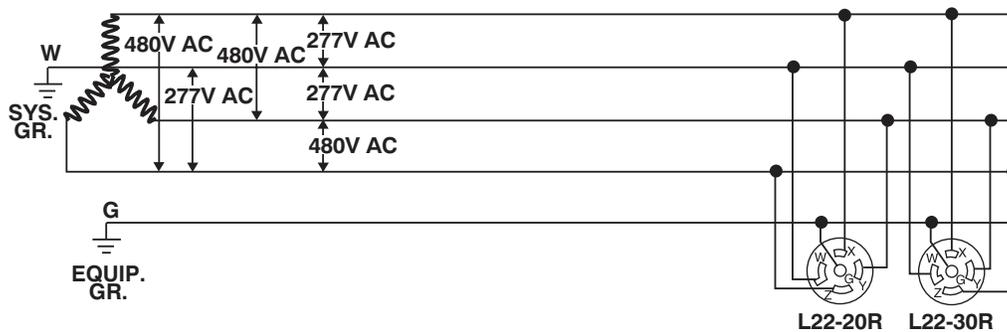
# Wiring Devices – NEMA Wiring Diagrams

## 4-Pole 5-Wire Grounding

**3 $\phi$ Y 120/208V AC**



**3 $\phi$ Y 277/480V AC**



**3 $\phi$ Y 347/600V AC**

