

National Power Mains and the Global Marketplace



Overview

Markets for electrical and electronic equipment are truly global and, because of this, more competitive than ever before. It is no longer sufficient to consider just those competitors in Los Angeles, Chicago, and Toronto. One must also be ready for competitors from Taipei, Osaka, Munich, and London.

Doing business in a global market is possible, accessible, and offers excellent business opportunities. "Product design and tooling are expensive," explained Bob Wersen, President of the Interpower Group of Companies. "By designing a product for sale worldwide, you can spread the expense over the largest market possible."

The Global Marketplace

Mr. Wersen explained that to sell globally, the following must be addressed: mains plug patterns, mains voltages, mains frequencies, markings on some components including cords, and national regulations. Most countries have their own type of plug pattern. Typical current ratings range from 10 to 16A, depending on the plug. Global mains voltages range from 100 to 250VAC. With universal input power supplies, this voltage range is not usually a problem. Mains frequencies throughout the world are either 50Hz or 60Hz. "All of the world's developed countries and many of the developing countries have electrical safety standards and most have safety testing agencies," he said. In addition, a number of countries/regions have environmental

restrictions on all substances contained in equipment sold in those respective areas.

"Some other good reasons for compliance to international regulations include enhanced quality and reliability of the product, meeting your competition head on, and peace of mind in knowing that you sell a product that is not only safe, but one that conforms to international expectations for safety," Mr. Wersen said. Choosing to export globally needs to be a well-researched decision. It is essential for those wanting to export to different countries to be knowledgeable in the desired country's import/export requirements.

In order to be successful now, it is essential to offer products that are easily adapted to the needs of local markets—without requiring reconstruction by the end-user. This is especially important with regard to power cords, circuit protection, and electromagnetic compatibility requirements. In fact, this is exactly what any successful domestic marketer would do to ensure the success of its products at home. The same rules now apply in export markets.

Customers today expect to unpack and use the product immediately, so knowing the product will operate at the customer's input voltage and frequency before shipment is crucial. If the product is running on the incorrect voltage or frequency, it will not be running at its full potential.

"In effect, the world has become a more cohesive market, in a global economy. When we talk about 'international' today, we mean a world that includes our own domestic market, not just the countries to which we export," said Mr. Wersen.

Power Entry Design for a Globally Accepted Product

A globally accepted product is one designed from the beginning to satisfy both North American and international product safety requirements. It is a product that can be easily adapted to meet the different power entry requirements of worldwide markets.

There are several important differences between North American, European, and international standards that affect the power entry design of a product accepted globally.

For voltages and frequencies, see Interpower's [Guide to Worldwide Plug/Socket Patterns and Power Mains \(Single-Phase\)](#).

Plug and Socket Patterns

Plugs and sockets meet an electrical need. They are the components used to connect electrical equipment to a power source. But as simple as that definition sounds, it needs to be noted that there are numerous plug patterns used throughout the world, making it anything but simple. When designing electrical or electronic equipment, the right plug and socket need to be specified to meet the requirements of the product. Because plug patterns vary greatly by country, it's important to determine how to correctly and safely connect to the power supply.

Today, manufacturers designing for global markets need to be aware that

there are many different plug patterns. They will need to determine which one is used in the country into which they will be exporting.

It is important to determine the following about plugs and sockets when designing and building a product.

Ratings

A plug and socket have a maximum voltage and amperage rating. The ratings are determined by national and/or international standards. They are set for safety purposes and are often higher than the actual current measurement at use. For example, if a Continental European plug is rated for 16A at 250V, it is unlikely that there will be a constant current of 16A at 250V flowing through the electrical connection. European voltage is standardized at 230V. In the United States, the National Electrical Code sets the standard for the common household use to be 120VAC.

Class I and Class II

Plugs and sockets can be rated for Class I or Class II applications. In a Class I application, the component must have the ability to provide grounding. In a Class II application, there is no grounding required.

Even though some electrical systems in developing countries may be ungrounded, it is not recommended to cut off the ground pin so that a plug can fit into a two-pole, ungrounded socket. This eliminates the safety ground connection and will cause the plug or socket to lose its approval. It is better to use a Class II plug on a power cord or cord set, than alter a Class I assembly.

Polarized or Non-Polarized

Polarized can have two meanings: electrical or pin. Electrical polarization means there is a standardized method of wiring the plug or socket to circuit wires. The circuit wires need to connect correctly to the line, neutral, and ground contact points on the plug and socket. The components mirror the electrical circuit. Pin polarization means there is a dedicated alignment of the pins—there is only one way of the plug fitting into the socket. Note: Even though a plug is pin polarized, it doesn't necessarily mean it is also electrically polarized.

Approvals

It's essential to include the correct plug and socket in the product design according to what is used in the country of export and to follow the specific standard (if there is one). In most countries, approval documentation is needed in order for the final product to be accepted into that country.

Choosing the Correct Plug Pattern

To assist in choosing the correct plug pattern, see Interpower's [Guide to Worldwide Plug/Socket Patterns and Power Mains \(Single-Phase\)](#) found on the website (www.interpower.com).

Before exporting, it is essential to confirm the country's current requirements because changes may occur within a country at any time.

Designing for Compliance— Some Strategies

Strategy 1: Design a Different Model for Each Set of Safety Requirements

This approach typically involves the design of one model of a product for sale in North America markets where the voltages are 120V at 60Hz and a second model for sale in export markets where power supply voltages range, for the most part, from 100–250V at 50Hz.

This approach is especially attractive in those situations in which the power supply cannot conveniently be designed to switch between voltages and frequency ratings. A country-specific strategy with a permanently attached power cord may provide a cost-effective alternative where large volumes of low value products are being shipped into one market (e.g. hair dryers to Germany).

To aid you in preparing products for specific countries, see Interpower's [Guide to Worldwide Plug/Socket Patterns and Power Mains \(Single-Phase\)](#).

Strategy 2: Design One Model to be Sold in All Markets

This approach is the choice of a growing number of designers and manufacturers because it allows one single product to be manufactured and sold worldwide. This approach is especially advantageous for the

North American equipment manufacturer who currently enjoys the largest homogeneous home market in the world.

The advantage of economies of scale can frequently be translated into a significant competitive edge in markets in which the competition is essentially local in character.

Strategy 3: North American Input—240V • International Input—220–240V

One design approach, which will minimize but not eliminate differences between North American and export models of higher current products, is to utilize a 240V input for North America and 220–240V for export models. Although this will not eliminate the need for different power cords, depending on the market, it will allow common circuit protection and power supply. This is true, provided that the power supply accepts 50 and 60Hz power.

One development that makes this alternative more attractive is the European decision to shift to a 230V electrical distribution system (from 220 and 240V systems). Please note that this is not an option for equipment with three-phase power inputs since the most standard three-phase inputs are 480V in the United

States, 600V in Canada, and 380–415V in international markets.

Strategy 4: Exporting Products Already Designed for North America Only

Manufacturers occasionally are interested in exporting, in small quantities, products already designed which comply with North American requirements only. Because of the small quantities involved, it may not be economical to redesign them to operate at 220–240VAC/50Hz. Furthermore, if these products are used in industrial or commercial environments, agency approvals are desirable, but not essential (unless required by law).

The manufacturer can still export a user-friendly product with minimal re-engineering by adding:

- An IEC 60320 power inlet
- An appropriate RFI filter so that the product satisfies European EMC regulations
- A circuit protection device
- An appropriate cord set (or power cord if the load exceeds 10A at 220V)

This solution will work if the power supply will generate on 50Hz power. If it operates on 60Hz power, a 50–60Hz power supply may be necessary.

Power Connections in Developing Countries

Information on electrical systems used in developing countries is imprecise. Formal electrical standards, where they exist, frequently do not cover plugs and sockets or are ignored in the marketplace. Furthermore, with regard to voltages and frequencies, power generating and distribution systems have been installed at various times by different contractors. These systems occasionally produce power at different frequencies and provide different voltages for final distribution. Therefore, some cities—even individual buildings in those cities—may be supplied by two or more generating plants and power distribution systems, each with a different single-phase voltage and frequency.

Additional Resources

Interpower offers free technical support. For more information about the various plug and socket patterns, see Interpower's [Guide to Worldwide Plug/Socket Patterns and Power Mains \(Single-Phase\)](#) found on the website (www.interpower.com). For further assistance, contact Customer Service.