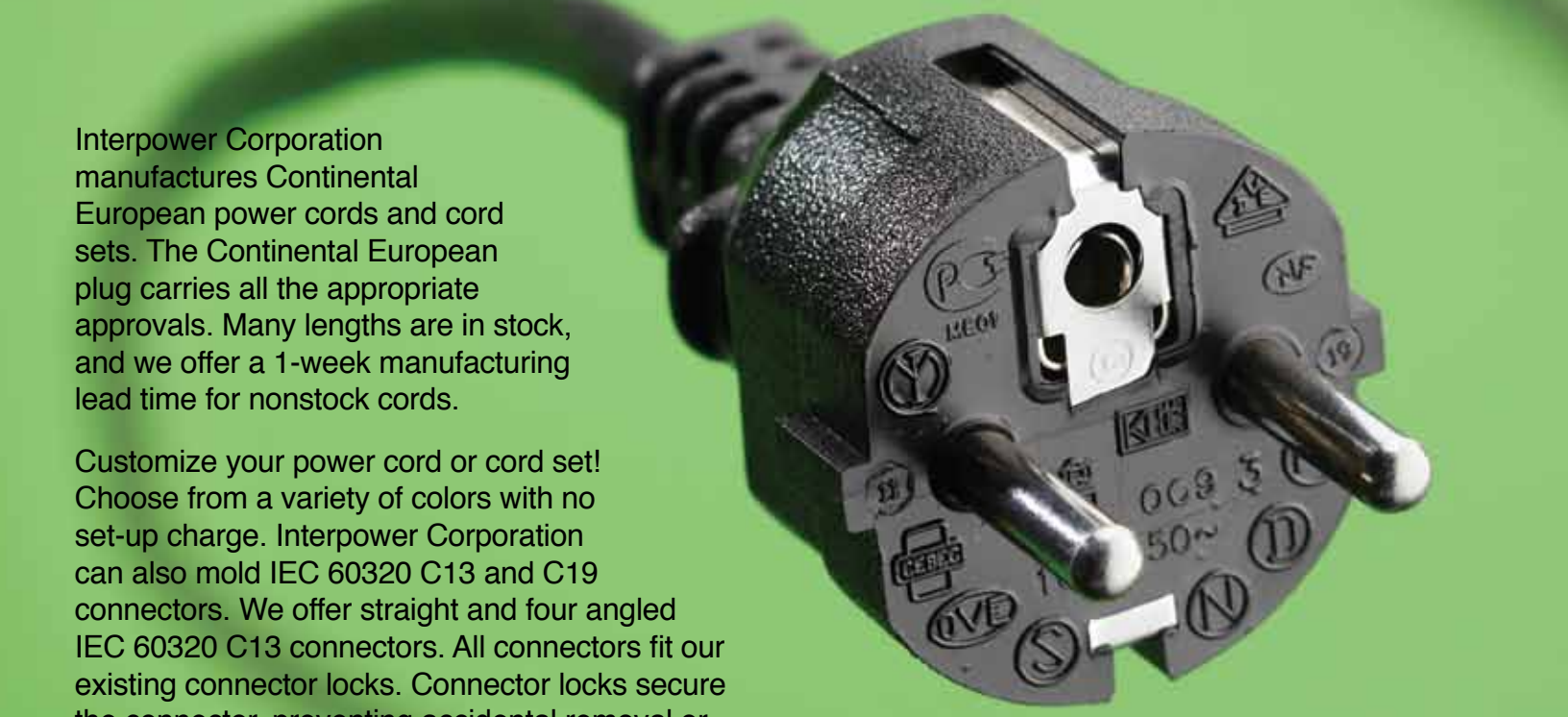
INTERPOWERSOURCE

FALL 2011 | ISSUE 1

21 Plug Patterns... *and Counting*

PLUS:

No minimum order requirements for Continental European cords



Interpower Corporation manufactures Continental European power cords and cord sets. The Continental European plug carries all the appropriate approvals. Many lengths are in stock, and we offer a 1-week manufacturing lead time for nonstock cords.

Customize your power cord or cord set! Choose from a variety of colors with no set-up charge. Interpower Corporation can also mold IEC 60320 C13 and C19 connectors. We offer straight and four angled IEC 60320 C13 connectors. All connectors fit our existing connector locks. Connector locks secure the connector, preventing accidental removal or interruption. Custom lengths, labeling and packaging are also available upon request.

Our Customer Service Department is ready to serve you from 7 a.m. to 7 p.m. Central Standard Time with no automated call attendant; receptionists answer every phone call. From 1 piece to 1,000 pieces or more we offer no minimum order requirements, so you only purchase what you need. With a 1-week manufacturing lead time, and no minimum order requirements, Interpower Corporation is your one-stop shop for power system components.

- Continental European plug carries all appropriate approvals
- 1-week manufacturing lead time on any nonstock Continental European power cord or cord set
- No minimum order requirements
- Same day shipment available for stock item orders received by 6 p.m. CST
- Customize cords to your specifications
- Made in the USA
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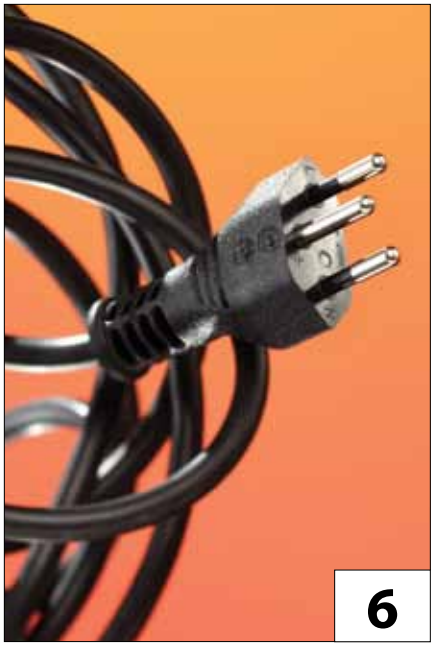

ON THE COVER

The cover shows just some of the 21 different plug standards used around the world. The plugs molded in color are the patterns discussed in this issue's cover story. Contact Customer Service to inquire about one of these plugs: sales@interpower.com

INTERPOWERSOURCE

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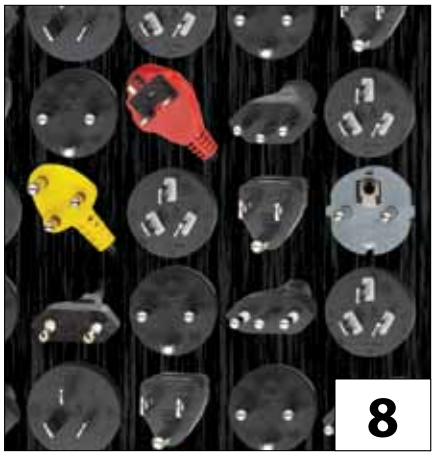
COVER STORY

FEATURES



DEPARTMENTS

EMPLOYEE FOCUS

Mike Boyle


Photo by Hannah Pothoven

Mike Boyle, Vice President of Manufacturing and Logistics, provides leadership for the manufacturing operations, shipping operations, maintenance, and buildings and grounds with responsibility for safety, quality and productivity.

In addition, Mike works on molds, repairs broken machines, and helps in other maintenance duties as needed.

Mike loves to make a task as efficient as possible, no matter how simple the task. He also likes the challenge of troubleshooting machines that are not operating properly.

Mike's best memory of working at Interpower Corporation was the time the company received a very large order that needed to be processed in a short period of time. In order to meet our commitment to the customer, the entire company pulled together. Everyone, from all departments, pitched in to help Manufacturing fulfill this order.

His favorite thing about his job at Interpower Corporation is the freedom to make decisions, within reason, that affect the areas that he oversees and making them happen in a relatively short period of time.

Before joining Interpower Corporation, Mike earned his BS Degree in Industrial Technology from William Penn College with a teaching endorsement. He has also worked as both a Tooling and Design Specialist and Plant Manager at a local manufacturing company.

Putting the Pieces Together

By Michelle Cooper

Recently, I received a call from one of our customer's who said that they felt compelled to let us know how DELIGHTED they were with the service from our Customer Service and Manufacturing teams. Here are their comments, in paraphrase:

Michelle, I have to tell you about the experience that I had with Interpower. Back in June I sent in a PO and through the miracle of technology you never got it, so I resent it. Raina and Charlotte worked to get the order placed and sent me a confirmation with a dock date of 7-29-11. I just couldn't believe that was what I saw so I emailed Raina and asked, 'is that your ship date or my dock date?' to which she replied that it indeed was my dock date as you were shipping today! From being in an incredibly tight position to a comfortable one in just 12 hours is amazing. Yes, only 12 hours since I just started my plea around noon yesterday. You guys amazed me. I mean it. I have been doing this for 17 years and I have never had this happen like this, with anyone. You guys just topped them all. I just can't believe that in less than 12 hours my PO was placed, parts were made, and my order is shipping. Like I said, I've been doing this for 17 years and I remember when your lead times were not so great and it took me a while to get things done with you. This has totally changed my mind on your company and I'm actually going to go through my part list and see what else I can throw your way. This was just awesome! I know you guys deal a lot with export products and about 35% of our business is in exports so I bet I can get a few more things over to Interpower. Really, this whole experience was just awesome (with the exception of my mishap in the beginning). You guys are just amazing!

The CSR's took the calls from the customer, they contacted the manufacturing department and explained the customer's dilemma, asked them what they could do to assist the customer with getting parts ASAP. Manufacturing looked at the situation, determined they could "stop the presses" and help this customer; the CSR's then relayed this information back to the customer.

The two departments working together "made it happen" and therefore we had a very happy customer. This is what we at Interpower Corporation are all about and what we work so hard to do for our customers, whenever possible.

INTERPOWER SOURCE

Editor in Chief
Bob Wersen

Writers
Kari DeBruin
Hannah Pothoven
Michelle Cooper
Ron Barnett
Ralph Bright

Photographers
Hannah Pothoven

Design
Deb Hamilton
Abby Pritz

Contributors
Hannah Pothoven
Judy Nunnikhoven
Pat Moore
Ron Barnett
Wendy Meyer
Raina Comstock
Dan Ford
Joe Caligiuri

Publisher
Interpower Corporation

Address
P.O. Box 115
Oskaloosa, IA 52577

Fax
800.409.0082

E-mail
info@interpower.com

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Given the cost of new product development, equipment designers today strive to design one product that they can sell globally with only minor changes to accommodate local electrical regulations and standards. This is especially true when markets are depressed as they are now.

Interpower Corporation has been selling international power systems components since 1975 and we've been manufacturing an increasing share of what we sell since the late 1980's. Along the way, we've accumulated a massive store of market intelligence about how to design equipment so that it is economical to customize it in order to meet local regulations and standards. We've concluded that if designers acknowledge right at the beginning that they will sell globally, it is usually pretty easy to address local requirements.

The purpose, then, of InterPowerSource is to provide a platform from which we can share what we know about specifying power systems components for use on equipment that will be sold globally, all in the interests of making our readers' jobs easier.

In this, our first edition, we are addressing four of the major plugs that are used on power cords in Europe and Israel. We will address more plugs in each future edition of InterPowerSource. In each discussion, we will provide an overview of the plug, its peculiarities, and the countries in which it is used.

We have articles on the new Swiss, Saudi Arabian and Brazilian plugs and on angle IEC60320 C13 connectors that are used on the end of the cord opposite the plug.

An article addressing current European regulations regarding chemicals and materials used in equipment, the so-called REACH directives, will contribute to your understanding of additional requirements facing equipment manufacturers and exporters.

And, we include information about Interpower Corporation and the people who provide the superior service that you've come to depend on from us.

In this and future editions, we hope to provide information about global power systems that will be useful to you in your everyday work. Please let us know how we can make InterPowerSource more useful to you.

Best regards,

Bob Wersen, President

REACH: What you need to know

By Kari DeBruin

What is REACH?

REACH is a European Regulation on chemicals and their safe use. (EC 1907/2006). It deals with the Registration, Evaluation, Authorization and Restriction of Chemical substances. The regulation entered into force on June 1, 2007. Registration of products containing chemical substances is required on manufactured or imported items by the European Chemicals Agency (ECHA). Failure to register will result in a company being denied manufacturing in or exporting to the European Union (EU).

Are companies outside the European Community Affected by REACH?

Yes—if you or your customers export your products to any of the following European Union (EU) countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom. Other countries, such as Iceland, Liechtenstein and Norway are a part of the European Economic area, and therefore, may have the same requirements.

Careful consideration should be given if you or your customers export any of the following items:

- Chemical substances (base or specialty chemicals, chemically modified natural substances and metals)
- Mixtures (preparations) of chemical substances (paints, cleaning products, motor oils)
- Chemical substances and/or mixtures in containers (ink cartridges)
- Items which contain intentionally released substances (scented items)
- Substances of high concern

If we export to the EU, what should we do?

Take Inventory: Document all current and future substance use as related to the REACH criteria. You can verify the uses or substances on the European Chemicals Agency website. Some substances and uses are exempt from registration.

Collect Data: Testing and data collection is tedious and time-consuming. Contacting suppliers directly for information can take many phone calls and emails, and it can take weeks or in some cases months for a response.

The process of data collection should begin with assessing and interpreting the REACH regulations and changes made to them. A system must be in place that immediately notifies relevant personnel as soon as a crucial change is made and ideally before it is made. This is essential to keep up with REACH, which will evolve over time. This system also comes in handy for staying on top of any number of important regulations and standards.

There are many ways to collect this data. Some companies will outsource this data collection. Companies who carry out these services can be found on the internet. There also is data collection software that can be used to organize the data you received from your suppliers.

Determine who will be responsible for gathering REACH information. It may be one person, or it may be an entire team that divides up the work. Once this is determined, those individuals should decide how they will collect REACH information. This team should contact your suppliers to request a list of all materials and substances used in each product, the amounts of the restricted substances, and any exemptions they may be using. You can provide your own restricted substances list to your supplier requesting this information. This will help the supplier report back with the information you requested in the format you need it for your products. Some suppliers may only send you a Declaration of Conformity for REACH.

Once you have received your requested information, review it carefully to verify that it is for the right products you requested, that it is complete and correct and it makes sense. If you notice any discrepancies or have any questions, you should contact the supplier immediately.

Finally, create a system to record or file the information you received. Try not to make your system too complicated, keep it simple. You will want to be able to get the information out to your customers quickly when they require data for REACH.

Where can I get more information?

To read more about REACH go to http://echa.europa.eu/reach_en.asp. You can also obtain a copy of the regulation and other guidance documents at http://guidance.echa.europa.eu/guidance_en.htm. If you have any questions, please let us know by emailing info@interpower.com.

Info**POWER** *Briefs*

By Hannah Pothoven

Interpower Corporation is the premier supplier of power system components and our mission is to make it easy for you to design, build and maintain products for worldwide markets. For this reason, we have started our blog, InfoPower. The InfoPower blog will provide you with a wealth of information on topics that are relevant to power system components.

There are 21 different plug patterns used around the world. That is daunting when you think about how an engineer is to keep track of which country carries what plug pattern, let alone voltage and frequency for each. In the InfoPower blog, Interpower Corporation will be

going over each plug pattern in detail the first Monday of each month to help you know exactly which plug to specify when exporting your products overseas. We have dubbed this *Power Mains Monday*. To date we have covered Continental Europe, Australia, the United Kingdom, Denmark, France, India/South Africa, and Israel.

Other topics covered include environmental standards information, how-to blog posts on selecting products, and agency approval requirements for various products.

You can view our blog at www.interpower.com/ic/infopower-2. For topics not addressed in our blog, please email us at infopower@interpower.com. For urgent needs, please call our Customer Service Department at (800) 662-2290 or email sales@interpower.com. Technical support is free and available from 7 a.m. to 7 p.m. Central Standard Time.

Letters to the Publisher

InterPower Source welcomes comments from our readers. Letters can be typewritten or e-mailed, and must include the author's full name, address, and telephone number. Address your submission to:

Interpower Corporation
2900 SE 5th St.
Ames, IA 50010

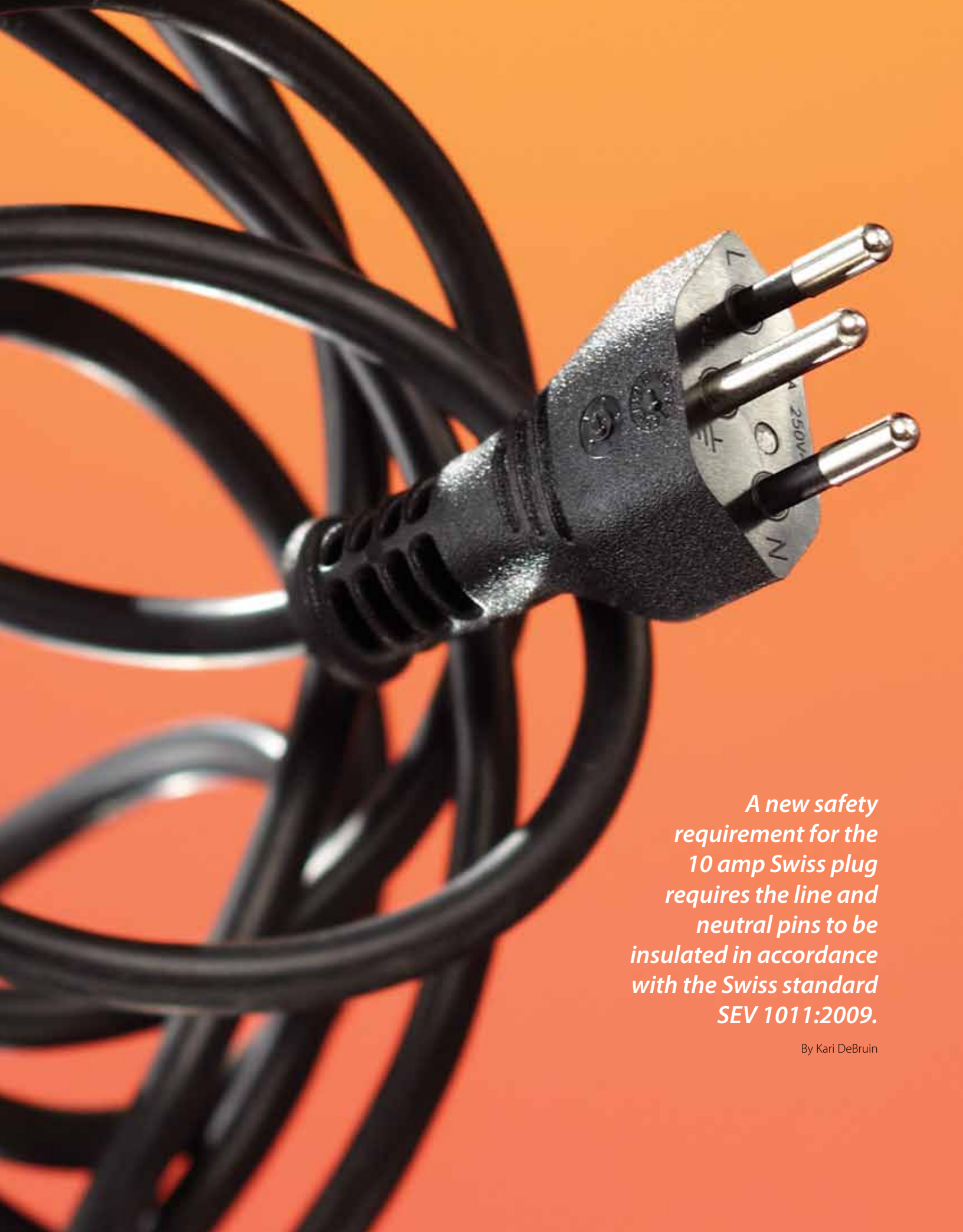
fax: 800-409-0082
e-mail: info@interpower.com

The editors reserve the right to edit letters for clarity, style, and length. We regret that unpublished letters cannot be acknowledged or returned.

POWERSOURCE *Play Fun Fact Answers*

1. Also known as the Continental European plug, it was developed in Germany by Albert Büttner in 1926 and is now one of the most commonly used systems in the world. *(Wikipedia & ABL.com)*
2. 131,482,560 feet of cable would be needed to circle the earth. The circumference of the earth at the equator is 24,902 mi / 40,076 km.
3. UL listed—granted for final assembly components; UL Recognized—granted for non final assembly components
4. Today, the use of copper and copper alloys in an average US-built passenger car is about 50 pounds, versus 36 pounds in 1980. *(copper.org)*
5. H05VV-F (rated 300/500V): Ordinary PVC sheathed flexible cable for use in offices, domestic premises, kitchens, for medium duties, i.e., washing machines, dryers, refrigerators. *(Interpower.com)*
6. Shielded cable is similar to unshielded cable in its composition, except it has an added aluminum "shield" that runs the length of the cable. The aluminum acts to pick up stray electrical charges, usually from "bleeding off" within the cable, where the charge may cause interference. *(Interpower.com)*

See page 29 for ***POWER****SOURCE Play Games*



A new safety requirement for the 10 amp Swiss plug requires the line and neutral pins to be insulated in accordance with the Swiss standard SEV 1011:2009.

By Kari DeBruin

Partially Insulated Swiss Plugs *Increase Safety*

As a matter of safety, there is a new requirement for the 10 amp Swiss plug. This new stipulation will require the line and neutral pins to be insulated in accordance with the Swiss standard SEV 1011:2009 (type 12, sheet 6534-2:2009), which replaces SEV 1011:1999. The current version of the 10 Amp plugs with non-insulated pins may be used until December 12, 2012. This new requirement does not apply to the Swiss 16 amp plug.

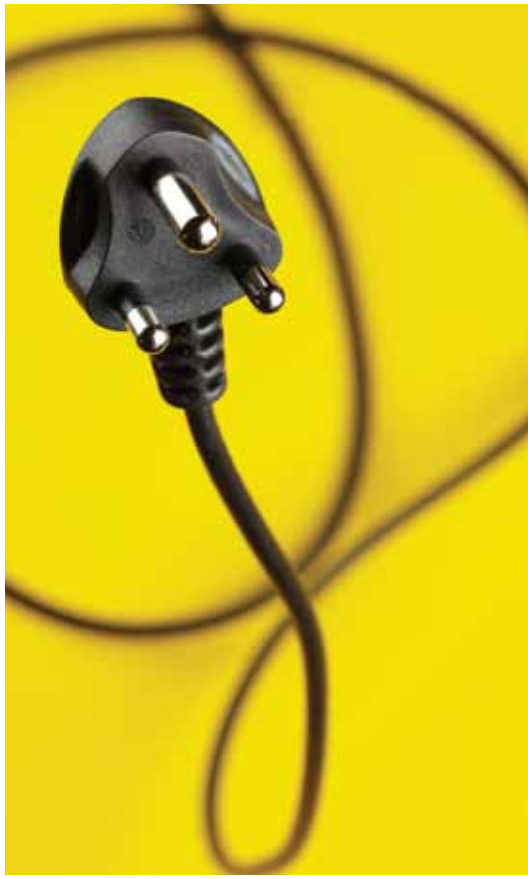
This new requirement was introduced in the type 11 (2-pin, 10A) and the type 12 (3-pin, 10A) plugs due to a number of injuries, including fatalities, involving both mains-plugs and plug-in-devices. When a metal object came into contact with a plug pin that was partially removed from a socket, it resulted in an electrical shock. The presence of the insulation will decrease the likelihood of unintentional contact when inserting and removing plugs from the socket.

This required change will impact manufacturers as the use of the new plugs will be enforced after the December 12, 2012 deadline. According to the Swiss Federal Inspectorate for Heavy Current Installations (ESTI), the following marketing specifications have been adopted and will be put into effect during the transition from the former plugs to the new Type 11 and Type 12 partially insulated plugs. These specifications are:

1. Non-Insulated Type 11 or Type 12 plugs cannot be produced or imported into Switzerland after December, 31, 2012.
2. Commencing January 1, 2013, all electrical goods, constructed or imported, are required to possess the new Type 11 or Type 12 partially insulated plugs.
3. Any products featuring the former non-insulated style of Type 11 and 12 plugs can no longer be sold and must be removed from stores by December 31, 2016.

Manufacturers and retailers will need to be mindful of the ESTI marketing specifications and deadlines. Interpower Corporation began manufacturing our 10 Amp Swiss plug with the insulated line and neutral pins, effective April 11, 2011. We implemented the change early in order to make it easy to design current and future products for use in Switzerland. In addition, this timely change allows our customers to be fully compliant prior to the Swiss standard SEV deadline.

In conclusion, products meeting the new partially insulated requirement in the type 11 (2-pin, 10A) and the type 12 (3-pin, 10A) plugs will provide increased safety for the end user. Utilization of partially insulated pins will reduce the chance of accidental contact when using the plug—avoiding shock. These safety requirements will be enforced after December 12, 2012. Additional marketing specification deadlines have been established by the Swiss Federate Inspectorate for Heavy Current Installations (ESTI) and will need to be observed by both manufacturer and retailer. Interpower Corporation has already begun producing the Swiss plug with the new partially insulated pins. Although these changes may be new for the Swiss 10 amp plug, other countries such as Australia, Italy, South Africa, and the United Kingdom also have insulated pins on their plugs.



21 Plug Patterns... *and Counting*

Our first in a series of articles covering the 21 worldwide plug patterns; this edition covers the following plugs: Continental European "Schuko," Euro, United Kingdom/Ireland, India/South Africa and Israel.

By Kari DeBruin

We are pleased to be launching a series of articles devoted to describing the 21 plug patterns that are currently used throughout the world. We will also discuss the plug manufacturing process at Interpower Corporation. In this article we will be covering the following plugs: Continental European "Schuko," Euro, United Kingdom/Ireland, India/South Africa and Israel.

We will begin by taking a look at the Continental European plug.

Continental European: CEE 7/4 and CEE 7/7 16A/230V/50Hz

The standard, Class I grounded mains plugs used in Germany, Austria, the Netherlands, Sweden, Norway, Finland, and Russia are the CEE 7/4 and CEE 7/7 plugs (also known as "Schuko"). Because this standard is used so commonly throughout Europe, we refer to it as the "Continental European"

standard. Both styles have two 4.8mm round contacts on 19mm centers. Grounding is achieved through the grounding clips on the sides of the plug body. The CEE 7/7 plug also includes a female contact that allows it to be connected to the French/Belgian sockets in order to engage their male grounding pin. All stocked Interpower Continental European cords utilize the CEE 7/7 plug.

The standard wall outlet in Europe provides consumers with 230V single-phase power. The standard practice for delivering this voltage differs from the North American method for providing 240V to the outlet. In North America, a 240V outlet would be connected to two live legs, each having 120V potential with reference to ground. The European system has one live leg carrying 230V with reference to ground, a neutral (the system ground),

and a safety ground. Consequently, the European 230V system is wired similar to North American 120V house wiring.

Practices differ mainly in the area of polarization. Typically, Europeans do not maintain consistent identification of line and neutral throughout their power system as is the practice in North America. Consistent with this practice, the Schuko plug can be rotated to either of two positions and plugged into the socket. Thus, the common electrical system in Europe is unpolarized (i.e., line and neutral are connected at random). In fact, most plug types used in Europe are not polarized.

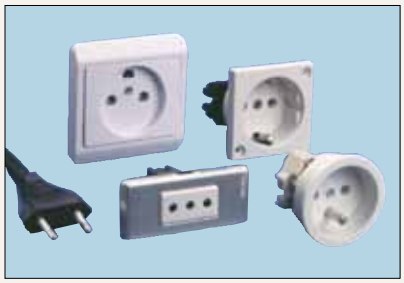
Schuko cord sets are available in three stocked cable sizes. Depending on cable used the power cords and cord sets are rated for service between 2.5–16 A at 250 VAC. Interpower Schuko power cords and cord sets carry all the major European approvals.

Countries that use the CEE 7/7 ("Schuko") plugs are Germany, Norway, Sweden, Finland, Austria, Netherlands, Belgium, France, Spain, Portugal, Greece, Poland, Czech Republic, Slovakia, Hungary, Romania, Russia, Corsica, Balearic Islands, Andorra, Luxembourg, and Monaco. Many more allow the use of this plug, see pages 14 & 15 for these listings.

Next, we will discuss the Euro plug.

Euro: CEE 7/16 2.5A/230V/50Hz

The standard 2-wire plug used in Class II, ungrounded, applications is popularly known as the Europlug, which is described in CEE 7/16. It will mate with any socket that accepts 4.0–4.8mm round contacts on 19mm centers. Countries that use the Europlug: Germany, Austria, Switzerland, Italy,



the Netherlands, Belgium, France, Spain, Portugal, Denmark, Norway, Sweden, Finland, Greece, Turkey, Israel, Poland, the Czech Republic, Slovakia, Hungary, Rumania, Bulgaria, and Russia. This plug is also used in the Middle East, most of Africa, South America and many developing nations.

Typically, this plug is generally limited for use in applications that require 2.5A or less. It is also unpolarized.

The Europlug power cord and cord set are designed for high-volume, end-consumer applications. If your application is above 2.5A, you should specify a Continental European power cord or cord set.

The Europlug mates with all standard wall sockets used in Continental Europe except the United Kingdom.

Now, we will discuss the United Kingdom/Ireland plug.

Note: *The Continental European plug will fit 10A sockets in Italy and Denmark. However, the Continental European plug will not be grounded. Therefore, we recommend specific plugs for Denmark and Italy.*

Note: *Russian approval agency GOST requires the CEE 7/7 plug be used for 16A applications.*

United Kingdom/Ireland BS 1363 13A/230V/50Hz

The official plug standard in the United Kingdom since 1962 is the BS 1363 plug. (The previous plug standard was BS 546, still found in older buildings.) The BS 1363 plug is also used in Ireland, Hong Kong, Malaysia, and Singapore. British standard BS 1363 requires use of a 3-wire grounded and fused plug for all connections to the power mains (including Class II, 2-wire appliances). The BS 1363 plug contains a BS 1362 fuse, which is designed to protect the cord and branch wiring back to the branch circuit protector installed in the building. British power outlets incorporate shutters on line and neutral contacts to prevent someone from pushing a foreign object into the socket.

In the British ring wiring system, a fault condition at an outlet, for example, will be sourced with current from both directions. This minimizes the amount of heat generated in the conductor, as the fault condition occurs, but before the circuit protection device can clear the fault. By minimizing the heat generated, the degradation of insulation (which accompanies overheating due to repeated fault conditions) is also diminished, improving the long-term safety of the insulation system.

Until the circuit protection device clears the fault, however, the fault condition is sourced from two different directions in the supply system. There is therefore a much greater potential fault current

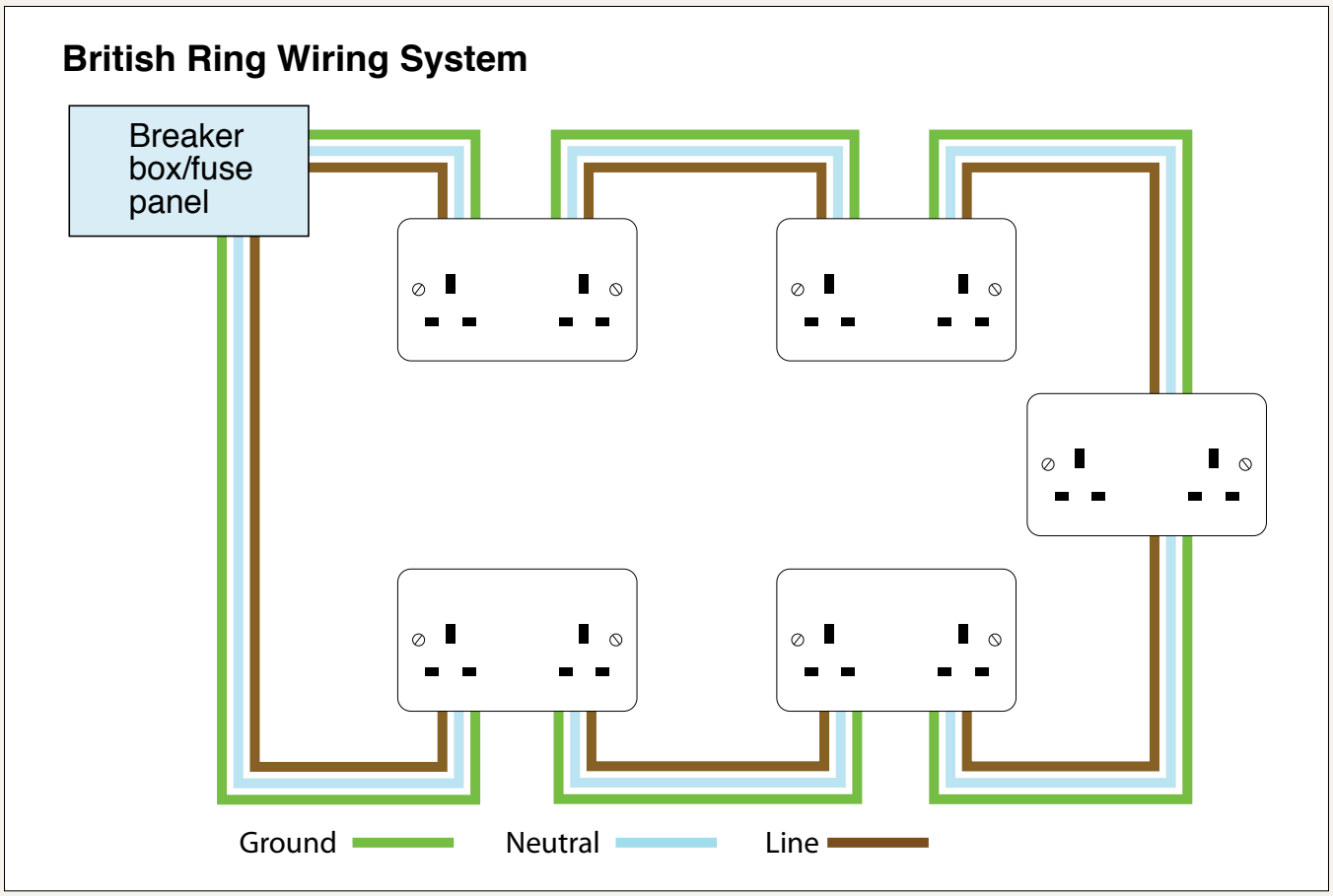


Illustration of British Ring Wiring System

condition. The British feel that a secondary protection device at the plug minimizes the safety hazard this condition creates; hence, the power plug fuse.

The fuse installed in all British plugs conforms to BS 1362 ("General purpose fuse links for domestic and similar purposes…"). The size of this fuse is 6.3 x 25.4mm. It has a breaking capacity rating of 6000A and is constructed with a sand-filled ceramic tube. The time-current characteristic on this family of fuses is not necessarily consistent with any other international standard, but it appears to have most of the characteristics of a fast acting fuse. The British Standards Institution standard for fuses in general is BS 4265.

Appliances tested and approved by British agencies can only use approved plugs, and these are tested by ASTA-BEAB to BS 1363. ASTA requires that their mark be molded into the plug.

The plug is rated from3–13A/250VAC, depending on the fuse. Standard Interpower British power cords and cord sets are approved by ASTA and carry the ASTA-BEAB mark.

Computers and other electrical devices that contain sensitive digital circuits, usually need to be protected from spikes and surge currents conducted into the product via the line cord. In North America, this is normally accomplished with the use of plug-in surge protectors that are dedicated to one computer or work station. Although not yet as common in Europe as in the U.S., surge protection is frequently provided in Europe through the use of centrally protected circuits. In these installations, a power distribution system that can exclude non-protected appliances is desirable. The reason is that the presence of an inductive load, such as a vacuum cleaner for example, on a protected circuit would potentially reinsert brush noise and spikes as the vacuum was turned on and off. This could completely negate the central surge protection.

The basis of the selective connection

systems used in Denmark and the U.K., is the plug and socket. The Danish plug/socket is a Danish national standard. The British do not have an official standard on plugs and sockets for data circuits. But there is in fact, at least one unique data plug/socket system used by a large British computer manufacturer.

Let's move on now to the India/South Africa plug.

India / IS 1293
South Africa / SANS 164-1
15A/220-230V / 50Hz

India and South Africa have standardized on a plug which was originally defined in British Standard 546 (the standard in the United Kingdom before 1962,

when the United Kingdom replaced it with BS 1363). The BS 546 standard is also used in parts of Southern Africa (i.e., Ghana, Kenya, Nigeria), the Middle East (i.e., Kuwait, Qatar), Nepal and parts of Asia and the Far East that were electrified by the British.

The plug is rated at 15A/250VAC.

Lastly, we will cover the plug for Israel.

Israel SI-32, 16A/230V/50Hz

Israel's standard plug pattern is defined in SI-32. The exception being the Europlug, which is used for Class II applications in Israel.

The cord set conforms to the requirements of this standard, carries SIMI (Standards Institute of Israel), and is rated at 16A/250VAC.

The Cord Manufacturing Process

By Kari DeBruin
Photos by Hannah Pothoven

As you can imagine, needing to know and understand the different requirements and specifications for each plug can be quite challenging. Interpower Corporation has established a strict course of action on all plugs that we produce to make sure the requirements and specifications are met. For the Continental European and United Kingdom plugs, the manufacturing process is as follows:

A team comprising of a Set Up Runner, a Production Runner, a Molder and a Tester oversee the production of the cords. The Setup Runner's duty is to prepare the machine and operation. The Set Up Runner will verify proper cable, length and strip information. Once this is complete, the proper blades and programming are set up for the cable that will be cut. Two pieces of cable will be cut to length and verified. The second piece is verified with the routing information. If there is a difference in length, this step will be repeated. Once set up is complete, the Set Up Runner makes sure the team is ready and proceeds to cutting cable.

Next, the needed crimpers are verified. A sample piece of cable from the allocated cable is used to set up crimp heights. After setting up the appropriate crimping machines, we proceed with producing cords.

Once machines have been set up, the Production Runner runs out four cords per batch. One batch is taken to the crimper to crimp the plug. If necessary, the connector is crimped. Next, appropriate UL labeling is applied. A visual inspection of the crimps, cable and quality is conducted. Pull tests are also performed at this stage.

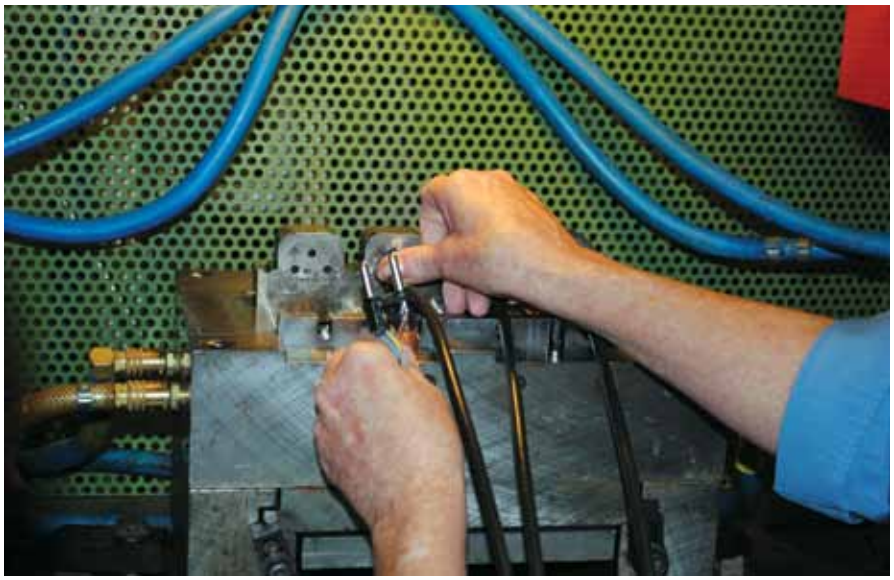
The Molder uses the routing information to verify which mold needs to be set up. Once the proper mold is in, the molding begins. Verification of having the right inserts, a pleasing cosmetic appearance and correct requirements is done. Once verified, molding proceeds.

Once molded, the product moves to the Tester. The Tester sets up the proper testing program and tests the fixtures. The final visual inspection and electrical testing of the finished cord is conducted. Once enough cords have made it through testing, they are ready to be boxed.

Other plug patterns are produced in a similar, although more manual fashion. Ensuring quality every step of the way, the steps taken for the other cords we manufacture are:

1. Cut cable to length
2. Strip conductors to length on both ends
3. Manually place a bridge into the crimper
4. Place each conductor (3) into the bridge
5. Cycle the crimping press to crimp the part
6. Repeat until the order is all crimped
7. Mold the parts
8. Test the parts
9. Box and ship

With the variety of plug patterns used in the world, it is important to know what each country specifies. We are able to provide you with that knowledge and ensure that our Team produces a product that meets the required specifications. It is not only important to us that you receive a product that passes the different criteria set forth by the various countries, it is important to us that you get a quality product. As you can see, every person on our team conducts an array of tests to ensure the quality of our products.



Loading the Schuko plug bridge cord sub assembly

For more information on plug patterns, please see our whitepaper, "National Power Mains." A link is available on our home page at www.interpower.com. You can also download our "Guide to Worldwide plugs and sockets Patterns & Power Mains" simply by clicking on our "Product Design Library" tab. For your convenience we have also included a copy of the guide in this edition of InterPower Source. Be sure to check out our next article on plug patterns in the next edition of InterPower Source. We will be discussing the plugs of Denmark, Argentina, Australia and China.

Visual inspection of the Schuko plug after molding

Guide to Worldwide Plug/So

The most frequently specified plug pattern for electrical or electronic equipment will appear in bold t
and are subject to a standard tolerance of 10% but in some areas—particularly in developing countri
and "Electrical Plugs and Wiring". Information current as of the time of publication. Subject to chang

Country	Voltage	Freq./Hz	Pattern
Afghanistan	220	50	A, B
Algeria	220	50	A, B, **F**
American Samoa	120/220	60	**C**, K, N, M
Angola	220	50	A,B
Anguilla (U.K.)	120/240	60	**D**
Antigua	120/240	60	**D,** K, N
Argentina	220	50	T
Armenia	220	50	A, B
Aruba	127/220	60	A, B, K., N
Australia	230	50	**C,** P
Austria	230	50	A, B
Azores (Portugal)	230	50	A, B
Bahamas	120	60	B, **K**, N, G, D
Bahrain	230/240	50	**D**, G
Bangladesh	230	50	D, G
Barbados	115	50	**K**, N
Belarus	220	50	A, B
Belgium	230	50	B, F
Belize	110/220	60	**K**, N, G
Benin	220	50	A, N
Bermuda	120	60	K, N
Bolivia	230	50	A, B, K, N
Bosnia-Herzegovina	220	50	A, B
Botswana	230	50	**D,** G
Brazil	127–220	60	B, K, N, O
Bulgaria	220	50	**A**, B
Burkina Faso	220/230	50	D, **G**
Burundi	220	50	**A**, B
Cambodia	220	50	A, B
Cameroon	220–260	50	B, F
Canada	120	60	**K**, N
Canary Islands (Spain)	220	50	A, B, F
Cape Verde, Rep. of	220	50	A, B
Cayman Islands	120	60	K, N
Central African Rep.	220	50	A, B
Chad	220	50	**A**, F, B
Channel Islands	240	50	B, **D**
Chile	220	50	**A**, B, I
China, People's Rep. of	220	50	**X**
Christmas Is. (Austral.)	240	50	C
Cocos Is. (Austral.)	240	50	C
Colombia	120	60	K, N
Congo, Rep. of	220–240	50	A, B, F
Cook Is. (N.Z.)	240	50	C, P
Costa Rica	120/240	60	**D**, K, N
Croatia	230	50	A, B
Cuba	115/230	60	A, B, K, N
Curacao Is.	110/220	60	A, K, N
Cyprus	230	50	**D**, G
Czech., Rep. of	230	50	B, F
Denmark	230	50	B, **E**
Djibouti, Rep. of	220	50	B, **F**
Dominica	230	50	D, G
Dominican Rep.	120/240	60	**K**, N
Ecuador	110	60	**K**, N
Egypt	220	50	A, B, D
El Salvador	120, 240	60	**K**, N
England	230	50	**D**, G
Equatorial Guinea	220	50	B
Estonia	220-330	50	A, B
Ethiopia	230	50	A, B, **I**
Fiji	240	50	**C**, P
Finland	230	50	**A**, B
France	230	50	B, **F**
French Guiana	220	50	B, F
Gabon	220	50	B, F
Gambia	220	50	D, G
Germany	230	50	A, B
Ghana	220	50	**D**, G
Gibraltar	240	50	D, G
Greece	230	50	A, **B**
Greenland (Den.)	230	50	B, **E**
Grenada	230	50	**D**, G
Guadeloupe	220	50/60	B, F
Guam	120/240	60	**K**, N
Guatemala	110/220	60	**K**, N
Guinea	220	50	B, F
Guinea-Bissau	220	50	A, B
Guyana	120/240	50–60	**D**, G, K, N
Haiti	110/220	60	**K**, N
Honduras	110/220	60	**K**, N
Hong Kong	220	50	**D**, G
Hungary	230	50	A, B
Iceland	230	50	**A**, B
India	230	50	G
Indonesia	220	50	A, B, F
Iran	220	50	A, B
Iraq	220	50	A, B, **D,** G
Ireland, Rep. of (S.)	230	50	**D**
Israel	230	50	B, **H**
Italy	230	50	B, **I**
Ivory Coast	230	50	A, B
Jamaica	110	50	K, D, G
Japan	100	50 & 60	J, M
Jordan	230	50	A, B, **D**
Kenya	240	50	**D**, G
Kuwait	230	50	**D**, G
Kyrgyzstan	220	50	A, B
Laos	220	50	A, B, F, **K**, N
Latvia	220	50	A, B
Lebanon	220	50	A, B, D, G
Lesotho	220	50	D, G
Liberia	220–230	50	A, N, K
Libya	220	50	A, G, K, N
Liechtenstein	230	50	L
Lithuania	230	50	A, B

* This country uses the Australia standard with modifications. The contacts are approximately 1mm longer than the Australian (18.2mm).

Cont. Europe (Schuko) CEE 7

plug: 88010801 socket: 88010610
cordset: 86230110

Australia/New Zealand AS/NZS 3112

plug: 88010713 socket: 88010512
cordset: 86210030

Denmark Afsnit 107-2-D1

plug: 88010741 socket: 88010541
cordset: 86391000

India/South Africa BS 546 (old British standard)

plug: 88010763 socket: 88010561
cordset: 86392000

Italy CEI 23-50

plug: 88010771
cordset: 86394000

Europlug CEE 7/16

plug: 88040030 socket: See A, E, F,
cordset: 86532100 I, & L

United Kingdom/Ireland BS 1363

plug: 88040011 socket: 88010621
cordset: 86240150

France/Belgium CEE 7

plug: 88010801 socket: 88010550
cordset: 86230110

Israel SI 32

plug: 88010780 socket: 88010580
cordset: 86393000

Japan JIS 8303

plug: not available
cordset: 86589000

cket Patterns & Power Mains (single phase)

ype. Note that the information provided for developing countries is not precise. The data given for single phase voltages and frequencies are nominal es—tolerances may be much greater. The information was compiled from several sources, including the BSI publications "World Electricity Supplies" e without notification. Call our Customer Service Department for current information.

Country	Voltage	Freq./Hz	Pattern
Luxembourg	230	50	**A, B**
Macao	230	50	D, **G**
Madagascar	110/220	50	B, F
Malawi	230	50	D, G
Malaysia	240	50	D, G
Maldives	220	50	D, G
Mali, Rep. of	220	50	B, F
Malta	230	50	D
Martinique	230	50	B, F
Mauritania	220	50	A, B
Mauritius	230	50	**D**, G
Mexico	127	60	**K**, N
Moldova	220	50	A, B
Monaco	220	50	A, **B**, **F**
Mongolia	220	50	A, B
Montseurrat	230	60	**D**, K, N
Morocco	220	50	A, B, F,
Mozambique	220	50	A, B, G
Myanmar (formerly Burma)	230	50	**D**, G
Namibia (W.S.Africa)	220	50	D, G
Nepal	220	50	G
Netherlands	230	50	A, B
Neth. Antilles	115–127/220	50/60	A, **B**, K,
New Caledonia	220	50	B, F
New Zealand	230	50	C, P
Nicaragua	120/240	60	**K**, N
Niger	220	50	A, B
Nigeria	230	50	**D**, G
North Ireland	230	50	D
North Korea	220	60	A, B
Norway	230	50	A, B
Oman	240	50	A, B, **D**, G
Pakistan	230	50	G
Panama	120/240	60	**K**, N
Papua New Guinea	240	50	**C**, P
Paraguay	220	50	A, B
Peru	220	60	A, B
Philippines	220	60	**K**, N
Pitcairn Is. (U.K.)	240	50	G
Poland	230	50	A, B, F
Portugal	230	50	**A**, B
Puerto Rico	120	60	**K**, N
Qatar	240	50	**D**, G
Romania	230	50	A, B
Russia Federation	220	50	A, B
Rwanda	220	50	A, B, L
Saudi Arabia	127/220	60	A, D, F, G, **K**
Scotland	230	50	D
Senegal	220	50	F, G
Seychelles	230	50	D, G
Sierra Leone	230	50	D, G
Singapore	230	50	D, G
Slovakia	230	50	B, F
Slovenia	220	50	A, B
Somalia	110/220-230	50	B, G
South Africa	220-250	50	D, G
South Korea	110/220	60	A, B, **K**, N
Spain	230	50	B, F
Sri Lanka	230	50	D, G
St. Pierre & Miquelon (Fr.)	115	60	K, N
St. Kitts & Nevis	230	60	**D**, G
St. Lucia	240	50	D
St. Vincent	230	50	D
Sudan	240	50	B, D, G
Suriname	127/220	60	A, B, K, N
Svalbard (Norway)	220	50	A, B
Swaziland	230	50	D, G
Sweden	230	50	A, B
Switzerland	230	50	L
Syria	220	50	A, B, F
Tahiti	110-127 & 220	60	A, B, F, K, N
Taiwan	110/220	60	C, **K**, N
Tanzania	230	50	**D**, G
Thailand	220	50	A, B, K, N
Togo	230	50	B, F
Tonga	240	50	C, P
Trinidad & Tobago	115/230	60	K, N
Tunisia	220	50	A, B, F
Turkey	220	50	A, B, D, G
Uganda	240	50	**D**, G
Ukraine	220	50	A, B
United Arab Emir.	220–240	50	**D**, G
United Kingdom & Ire.	230	50	**D**, G
United States	120	60	K, N
Uruguay	220	50	A, B, C*, **I**
Venezuela	120/208/277	60	**K**, N
Vietnam	220	50	**B**, **F**, K, N
Virgin Islands	120	60	**K**, N
Wales	230	50	D, **G**
Western Samoa	230	50	C
Yemen	250	50	**D**, **G**
Yugoslavia	230	50	A, B
Zaire, Rep. of	220-240	50	A, B, F
Zambia	230	50	D, G
Zimbabwe	220–230	50	**D**, G

Interpower Corporation
P.O. Box 115 • 100 Interpower Ave.
Oskaloosa, IA 52577 (USA)

Telephone: (800) 662-2290
Fax: (800) 645-5360
Web Site: www.interpower.com

socket: 88010572

North America
NEMA 5-15

plug: 88030100 socket: 88010641
cordset: 70401020244

Japan
Ungrounded

plug: not available socket: not available
cordset: 86532140

Australia
Ungrounded

plug: not available socket: 88010512
cordset: 86532110

China
GB 2099-1 & GB 1002-1

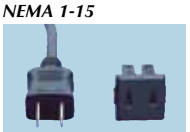
plug: not available socket: not available
cordset: 86517040

socket: not available

Switzerland
SEV 1011

plug: 88010732 socket: 88010530
cordset: 86396000

North America
NEMA 1-15



plug: not available socket: 88010641
cordset: 86532120

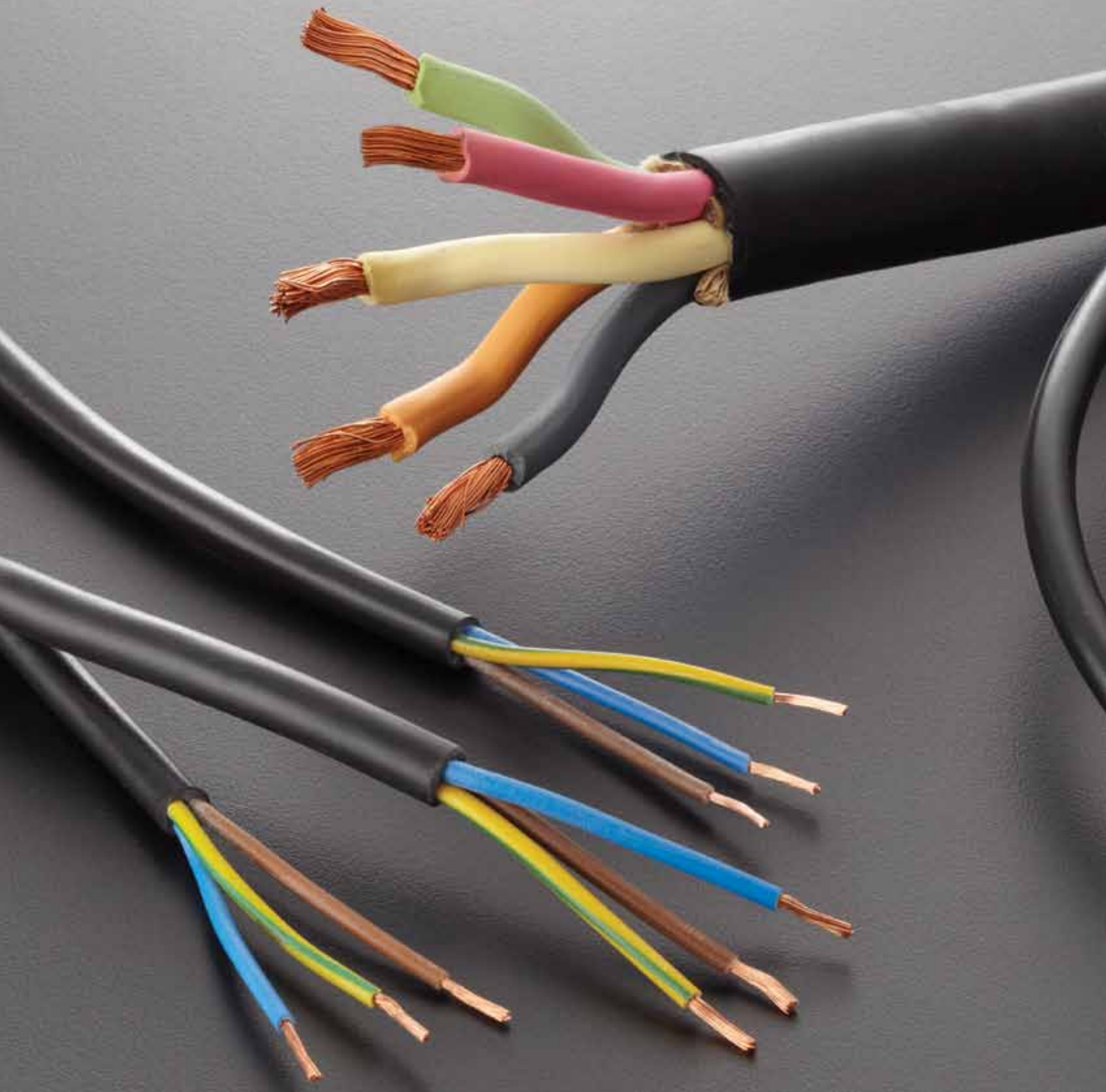
Argentina
IRAM 2073

plug: not available socket: not available
cordset: 86270010

Brazil
NBR 14136

plug: 88040200 socket: not available
cordset: 86286110

Stripping and Cutting



g and Crimping…
Oh My!

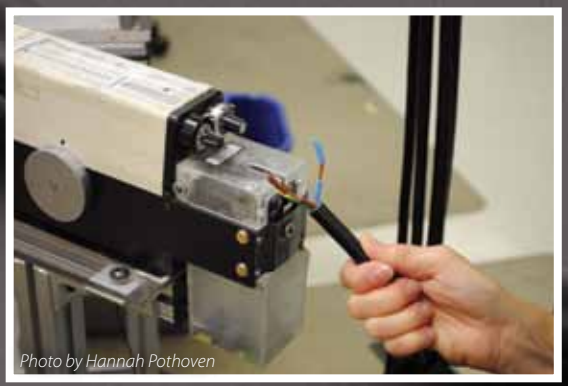
The difficulty of cutting and stripping cable, especially large diameter rubber cable, may not be worth the savings of purchasing bulk cable.

By Kari DeBruin

Processing cable to meet your production needs can be a tedious and difficult task. It requires you to purchase and maintain expensive equipment, or process the cable by hand which could result in higher labor costs, and greater margin for error. If you routinely use large diameter cable the process can become even more difficult and time consuming.

Every piece of cable is different, there are varying diameters, outer jacket materials, shielding, and a variety of other ways that cable can be made to meet the needs of the end user. Not to mention the various lengths, special tolerances, and custom strips that might need to be met in order for the assembly process to be completed.

So what options do you have? Well, if you process enough cable it could be easy to justify the expense of a machine fully dedicated to your cable cutting needs. But if you are a small company with limited needs, or if you have no space to house such equipment the answer could be as easy as asking your cable supplier if they can help.



Stripping the insulation from the conductors. The "insulation slug" is left on to protect the strands during shipping

Interpower offers a full line of value added services, and cable cutting is one of them. We take your drawing or specifications and cut the cable to meet your needs. So when the cable arrives at your door all you will need to do is complete the assembly. With our current machines, we can process cable from as small as 6.2mm all the way up to 25mm in diameter. We also have no minimum order quantities. So, from the one-time need to the ongoing production quantities, feel free to see what Interpower can do for you by visiting our website www.interpower.com for more details.

Saudi Arabian Standards Changed and Enforced

As of February 2010, SASO 2203 has changed and enforces new requirements and establishes a significant standard for testing plugs and socket-outlets for household use.

By Kari DeBruin

The Saudi Minister's Cabinet has issued decree No. 55 21/2/1430H on the implementation of Saudi standards SASO 2203/2003 & SASO 2204/2003 for plugs and sockets entering into Saudi Arabia. "SASO" is the Saudi Arabian Standards Organization. The Saudi Custom Authorities announced that these changes would be enforced as of February 23, 2010. SASO 2203 defines the requirements and establishes a significant standard for testing plugs and socket-outlets for household use.

These standards include:

1. Marking the country of origin on plugs and socket-outlets—SASO requires that the country of origin (where the product is manufactured and/or assembled) be clearly marked on all plugs and sockets.
2. Compliance with visual testing, insulation resistance and electrical strength—Sample requirements: 21 samples are required for plugs, 33 samples are required for switched socket-outlets and 27 samples are required for unswitched socket-outlets.
3. Environmental conditions—The tolerances for testing products are 23°C ± 2°C.
4. Creepage and clearance—the SASO standard only defines the measurement of distances including a minimum of 0.8mm for insulation thickness.
5. Heat resistance/Material Test—Ball pressure: Plugs and socket-outlets are tested at 125°C; Glow wire: Plugs and socket-outlets are tested at 850°C; Resistance to heat: Plugs and socket-outlets are tested at 100°C.
6. Temperature Rise—35ºC for any terminal

Interpower Corporation began the approval process last year to meet this Saudi Arabia requirement. As of February 2011, the Interpower UK plug type 037 now carries the Saudi Arabia approval.

The approval marking is located on the face of the plug along with the ASTA approval. The marking reads SASO-2203. As noted earlier, the acronym "SASO" stands for Saudi Arabian Standards Organization and the numbers "2203" represent this Saudi Arabia Plugs and Sockets standard. Meeting the Country of Origin standard, we have added to the face of the plug, "Made in the USA."

Any length...
Any quantity...
1-Week

1-week manufacturing lead time on nonstock cords

Interpower Corporation manufactures a wide range of North American and international power cords and cord sets. Whatever your requirements are, from 1 piece to 1,000 pieces or more, we offer **no minimum order requirements**. Interpower Corporation offers **same day shipping** for cords in stock, and a **1-week manufacturing lead time** on any nonstock cord. Any plug… any length… any quantity… we'll ship it to you in 1-week.

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- No minimum order requirements
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A Closer look at the Brazilian Plug Standard

The standard for plugs and receptacles, based on the international IEC 60906-1 standard which was developed to encourage countries to adopt one plug and receptacle for global use.

By Kari DeBruin

The Brazilian 10 amp and 20 amp plugs are rated at 250VAC and use a plug pattern exclusively for use in Brazil. The power cords and cord sets bear the Inmetro/UL Brazil approval mark. The addition of this plug was prompted by the creation of the Brazilian plug standard NBR14136:2002. The creation was based on the Conmetro Resolution 11, as of December 11, 2006, which considered two types of plugs: the plug to be sold as a separate piece (not part of equipment) and the plug that is part of a connector cord used on equipment or part of an extension cord.

Plugs that are sold as separate pieces have been required to be manufactured according to NBR 14136 with respect to the dates listed below:

- Two pins (phase-phase or phase-neutral), rewireable (can be assembled by the user): as of August 1, 2007;
- Two pins, molded (injected): as of January 1, 2008;
- Three pins (phase-phase-ground or phase-neutral-ground), rewireable and molded as of January 1, 2009. Plugs (2 and 3 pins) that are part of a connector cord used on equipment or part of an extension cord were required to be manufactured according to NBR 14136 since January 1, 2010.

The Brazilian NBR 14136 standard is for plugs and receptacles. It is based on the international IEC 60906-1 standard, developed to encourage countries to adopt one plug and receptacle for global use. To date, Brazil is the first known country to adopt this configuration. The new NBR 14136 standard would eliminate the majority of plugs and receptacles currently produced or sold in the market. Specifically, the standard would eliminate the so-called "universal" receptacles, which are compatible with the U.S. NEMA 1-15, NEMA 5-15 and European style plugs (two round or two flat prongs.) The Brazilian receptacle would continue to be compatible with the Euro plug which has 2 round prongs. Besides plugs and receptacles, the new standard also applies to all products that incorporate plugs on their power cords.

The new Brazilian plug might look familiar; it is very similar to the Swiss plug. The plug bodies have approximately the same dimensions with the Brazilian plug being 0.5mm wider. Unfortunately, the plugs are not interchangeable. The Brazilian plug will not fit into a Swiss socket and vice versa. The minimum height of the plug face is one other dissimilarity between the two plugs.

The Brazilian plug must be a minimum of 17mm, whereas the Swiss plug must be a minimum of 14.5mm. Unlike the Swiss, the pins in the Brazilian plug are not required to be insulated. If the pins are insulated, they may be subject to more testing. The distinct difference between the Brazilian and Swiss plug is the spacing of the pins. The pins on the Brazilian plug are closer together than the pins of the Swiss plug.

Pictured here are the uninsulated Brazilian rewireable plugs and connectors in the Interpower product line; the 10A/250VAC rewireable plug 88040200 and connector 88040210, and a 20A/250VAC rewireable plug 88040300 and connector 88040310 . These products are approved by INMETRO, and are tested by TUV. The mating 10A and 20A plug and connector offer a special locking feature for safety.

The Interpower C13 connectors are designed for use with North American cable sizes ranging from 14 AWG to 18 AWG and international harmonized cable sizes from H05VVF3G0.75mm^2 to H05VVF3G1.50mm2.

- Connector locks (85910071, 85910075) are available from Interpower that are designed to fit the C13 connector bodies. This provides extra retention in applications where it is critical that connectors are not pulled free from the outlet.

Interpower has "All the Angles" you need and offers a 1-week manufacturing lead time on nonstock cords with no minimum order requirements.

If you would like to know more about the different connections, you can download our free IEC coupler chart from our website at: http://www.interpower.com/coupler

Going Up! Or Down! Or Left . . . *Or Right!*

By Ron Barnett

Did you know that there are five different IEC 60320-1 C13 connector configurations? The connectors can cover 365° of possible rotation with the straight version, right angle, down angle, left angle and up angle. The various C13 angles allow for connections to be made to equipment helping to eliminate the possibility of pinched or tangled cable. These are ideal for areas where space is limited between the equipment and the wall or where cord lengths need to be kept to a minimum for a "tight or clean look" such as on equipment racks. In addition, having the correct angled cord prevents pinching; providing safer routing of the cable.

C13 connectors are typically rated at 15 Amps/125/250 VAC for North America and 10 Amps/250 VAC for international use and are RoHS approved per Directive 2002/95/EC of the European Parliament.

Most C13 connectors carry UL (United States), CSA (Canada), VDE (Germany), IRAM (Argentina) PSE (Japan) and Department of Fair Trading (Australia) approvals. The connectors also must carry the CE marking and RoHS approval when going to Europe.

Dimensional and performance criteria for C13 connectors are established in IEC 60320-1 in which they are described as appliance couplers in this section. Individual countries may adopt this standard or make modifications of it to meet their own standard requirements.

Common usages for C13 connectors include desktop computer applications along with various power supplies. Other C13 facts:

- The C13 connector is designed to mate with a C14 inlet.
- The C13 connector series are available in a number of different colors from Interpower.
- The C13 connector body is made from polyvinyl chloride (PVC) rated at UL94V-0 and is over-molded on an insert with three phosphor bronze contacts.
- Having five different angles to choose from allows connections to be made to equipment with no possibility of pinched or tangled cable.

Whether space is limited between the equipment and the wall or minimum cord lengths are necessary for a nice clean look, having "all the angles" is essential.

Upcoming Trade Shows

Each year Interpower Corporation attends shows throughout the United States and Europe. Not only does it give us the opportunity to display and highlight our products, but it also gives us a chance to visit with you. Stop by and see us at one of the following shows.

November 2–3	**MDM Minneapolis** at the Minneapolis Convention Center in Minneapolis, MN; Booth # 615
November 15–18	**Productronica** at the Messe Munichen in Munich, Germany; Stand # A2-116
February 14–15	**MDM West** at the Anaheim Convention Center in Anaheim, CA; Booth # 3408

Multi-line Sales Representatives Provide Local Expertise

A 34 year partnership commits to delighting customers and meeting their needs.

By Judy Nunnikhoven

Hughes Cain & Associates

Sales of Interpower Corporation's products are handled through Multi-line Sales Representatives. Interpower Corporation's sales team is made up of nineteen representative firms located throughout the United States and Canada. These representatives are very knowledgeable about Interpower Corporation's products and are available to assist customers with design applications, order placements, expediting orders, and any other support that a customer may need when considering and using Interpower's products. A complete list of all of our Manufacturers Sales Representatives can be found on page 26.

The Sales Representative we have worked with the longest, is Hughes Cain & Associates; they have been with Interpower Corporation since 1977. Hughes Cain & Associates represents several companies that manufacture synergistic lines of electronic and electro-mechanical components.

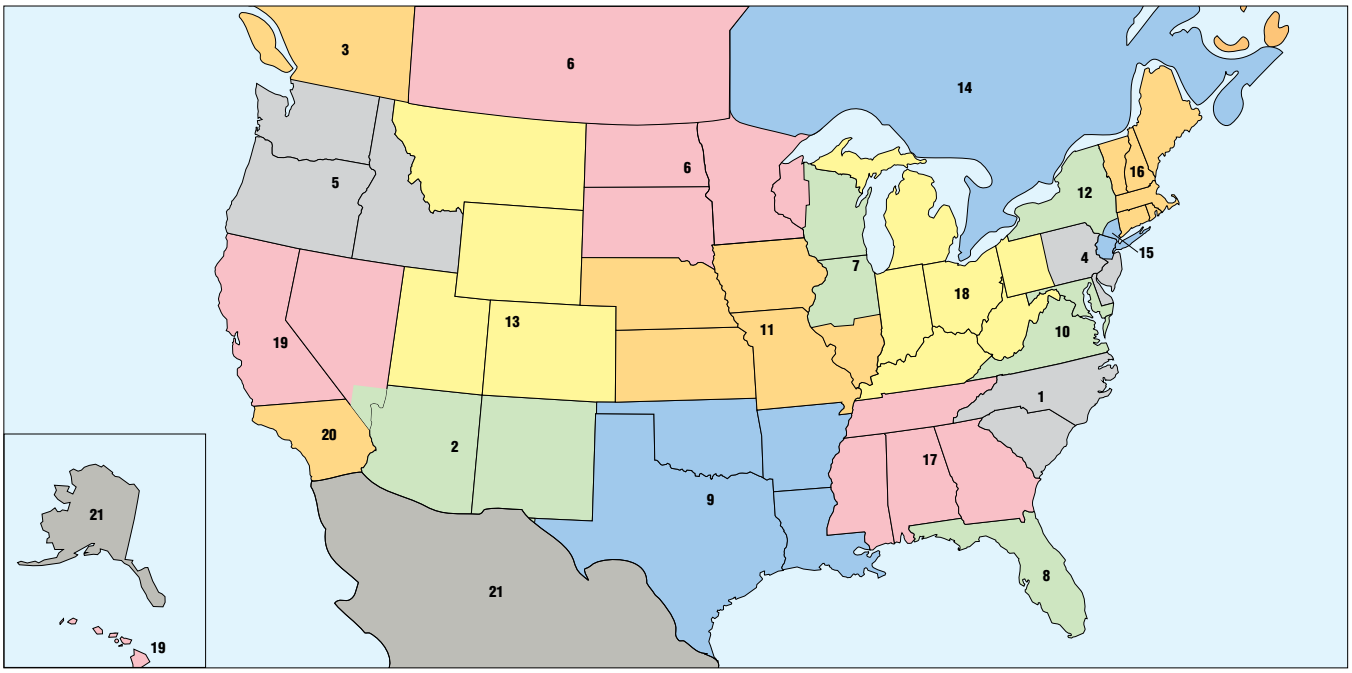
Hughes Cain & Associates covers the states of Texas, Oklahoma, Louisiana and Arkansas. They have six employees in three locations in Texas and strive to be the best representative firm in the Southwest through honest representation of their products and fulfilling their customers' needs. Hughes Cain & Associates is large enough to cover their territory well, yet small enough that each employee can take pride in the fact that he or she is making a substantial contribution to Interpower's overall success.

One of the reasons that Interpower Corporation and Hughes Cain & Associates have had such a great working partnership is their joint commitment to delighting their customers and meeting their needs. Jimmy Hughes, President/Owner, remembers an instance where a customer that had ordered some custom pin and sleeve assemblies for a project they were working on. The customer had specified the wrong connector on one end of the assemblies, but had not realized this until they were ready to ship the finished product to their end customer. This of course created an emergency situation and Jimmy contacted Interpower Corporation, explained what had happened and the urgent need for new parts to be able to ship the customer's products to them. Interpower Corporation manufactured and sent replacements within a few days, and worried about sorting out the "details" after the fact. The customer was delighted to be able to ship their products on time to their customer.

One of the most unique requests Hughes Cain & Associates ever received for an Interpower product was a pigtail cord set with six C13 connections located about 10 inches apart. Unfortunately, Interpower Corporation was not able to help this customer with this particular request as it was not within their design and manufacturing capabilities.

If you are located in the Southwest and would like a visit from Hughes Cain & Associates to assist you with a project, they have three offices to serve you. The Lewisville, TX office number is 972.221.1536, Georgetown, TX office phone number is 512.528.0607 and Brownsville, TX office number is 011.52(186) 8158-1123. Their web address is www.hughescain.com

Looking for an Interpower Corporation Sales Representative?



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Phone 954.304.4648
Fax 407.829.8798
bderamo@hhpai.com
www.hhpai.com

9. Hughes Cain & Associates
Lewisville, TX 75067
Phone 972.221.1536
Fax 972.221.1537
jimmy@hughescain.com
www.hughescain.com

Hughes Cain & Associates
Georgetown, TX 78628
Phone 512.528.0607
Fax 972.221.1537
chris@hughescain.com
www.hughescain.com

Hughes Cain & Associates
Brownsville TX 78526
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Phone 914.390.9150
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www.pacentengineering.com

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Lincoln Park, NJ 07035
Phone 973.709.9616
Fax 914.390.9152
tony@pacentengineering.com
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Phone 770.662.8982
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Phone 937.456.5005
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19. Ross Marketing Associates
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Phone 650.691.0119
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Phone 714.544.1888
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www.schoenbachlerems.com

Schoenbachler EMS
Torrance, CA 90503
Phone 310.371.4282
Fax 310.371.2623
semsla@msn.com
www.schoenbachlerems.com

21. Interpower Corporation
Oskaloosa, IA 52577
Phone 800.662.2290 (US/CAN/PR/VI)
641.673.5000
info@interpower.com
www.interpower.com

POWER *Pointz*

By Ralph Bright

Electronic equipment is often designed with built-in circuit protection. This protection usually comes in one of two forms: a circuit breaker or a fuse. This article will explain the differences between fuses and circuit breakers and help designers understand when to use a fuse and when to use a circuit breaker.

FUSES

What is a fuse?

A fuse is a safety device that protects an electric circuit from excessive current. When the current, or flow of electricity, exceeds what the fuse is designed to withstand, the fuse opens the series circuit, which then disconnects the load from the power source. When a traditional fuse disconnects or "blows" it must be removed and replaced with a new fuse.

How does a fuse work?

Typically fuses are constructed using a thin metal strip or filament sheathed in a transparent glass or plastic enclosure. The metal strip is attached on each end to a separate terminal on the outside of the fuse. These external terminals mate with matching terminals attached to the protected circuit. Any current that moves through the circuit flows through the metal inside the fuse. If the metal overheats, it will melt, breaking the electrical connection.

What are the advantages and disadvantages of using fuses?

Fuses offer a couple of advantages over circuit breakers. First, they are more cost effective. Second, and perhaps more importantly, they are easier to modify when a product is being designed for multiple markets. For example, a North American product operating at 115VAC might be protected with a 6A fuse. The same product could be shipped into an international market where it will run on 230VAC. To accommodate the 230VAC power supply, the 6A fuse could be exchanged for a 3A fuse. This change can be made quickly and easily, by simply using a fuse holder that is compatible with both North American and international fuses and fuse carriers. The designer using a circuit breaker, rather than a fuse in this scenario, could be faced with extensive redesign requirements when shifting from a circuit breaker compatible with North American power requirements to a circuit breaker compatible with international power requirements.

A disadvantage would be that an ordinary fuse cannot blow as quickly as a circuit breaker can "trip."

Another disadvantage would be that some equipment may require special "quick-blow" fuses so that damage can be prevented when an over-current fault condition occurs. Quick-blow fuses cost much more to make than ordinary fuses but must sometimes be used where a circuit breaker would be too expensive and/or too large in size.

CIRCUIT BREAKER

What is a circuit breaker?

A circuit breaker is an automatic switch that prohibits the flow of electric current when it is rapidly overloaded or unusually stressed.

How does a circuit breaker work?

When the current is larger than the circuit breaker is designed to handle,

the switch contacts open, breaking the current. This occurrence is often referred to as being "tripped." When the issue is resolved (whatever "tripped" the circuit is repaired) the circuit breaker can be reset by a push of a button or a flip of a switch. The contacts will remain closed unless another over-current fault condition occurs in the protected circuit, causing it to trip again.

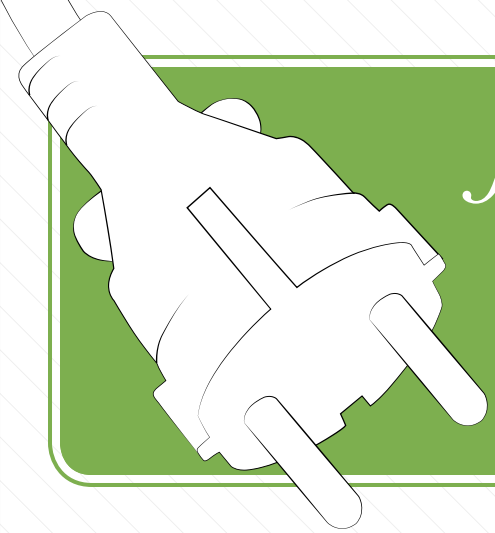
What are the advantages and disadvantages of using a circuit breaker?

Circuit breakers can be designed to trip more rapidly than fuses, although they are typically larger and more costly.

An advantage to using circuit breakers is that they are reusable and can simply be reset after they have tripped.

Knowing the differences between a fuse and circuit breaker including the advantages and disadvantages of each, will help the designer make the correct choices when creating their products.

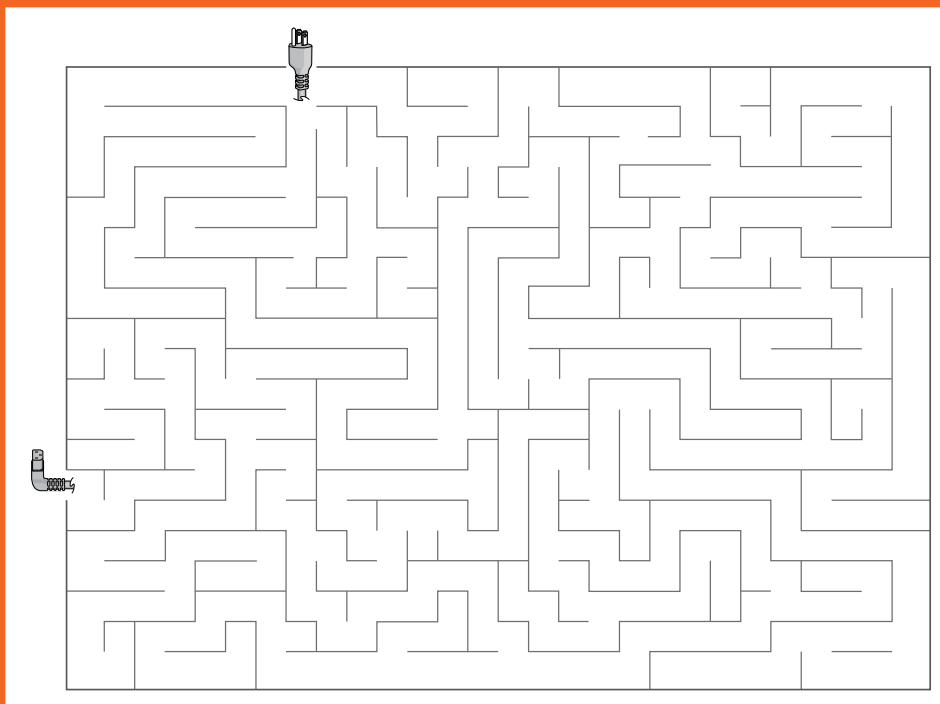
POWERSOURCE *Play*



fun FACTS

1. Where did the Schuko plug originate?
2. How much cable would it take to circle the earth?
3. What is the difference between UL listed and UL recognized?
4. How much copper is used in a U.S. built automobile?
5. What does H05VVF mean for international cable?
6. What is the purpose of shield in cable—shielded versus non shielded?

MAZE



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