Sounds Like Nothing At All

XLO™ Purple Rush™ AC Power Cord White Paper

Purple Rush uses continuous cast/multi-gauge/multi-shape conductors to overcome AC transmission line problems. Its audacious low-noise, low-loss, high-speed design was awarded five separate patents! Powerful monoblock amplifiers to front-end separates all achieve a breathtaking openness and transparency, lightning quick transients, incredible slam and palpable imaging with seductive warmth and richness.

Purple Construction Techniques

The Purple Rush power cord is packed with unique technologies. It's constructed of 6 AWG PC-OCC copper in multiple gauges and shapes. Fine gauge PC-OCC conductors are used for the highs; one massive solid flat PC-OCC conductor for the midrange; and multiple gauges of large-diameter, individually-insulated, solid-core PC-OCC conductors bundled together for the bass. That's the power cord's secret; it literally embodies the best of all possible worlds for a most accomplished sound.

The Midrange Problem

In the past we found that varying conductor gauges to optimize bass, midrange and treble frequencies was effective, but we knew there was more we could do. Bass were never really an issue as large gauge conductors optimize bass frequencies. Similarly small-gauge conductors are best for treble frequencies. Common sense dictates that medium gauge conductors ought to be a good match for midrange frequencies because of the increased core size and surface area. While that's true, finding the best ratio of core size surface to surface area for midrange frequencies has always been something of a fine art.

In the midrange we need *more* surface area than core size, but in a round conductor that's actually impossible as the core size and surface area scale proportionally -- in a fixed ratio -- as the diameter changes. To find an asymmetrical ratio of surface area to core size we tried bundling small- and medium-gauge solid-core conductors to increase surface area; it worked, but not well enough.

We found an excellent solution in U.S. patent 6,969,805 filed by well-known designer Jay Victor of Orbital Development and licensed it. The patent described an elegant solution to the "midrange problem": rectangular conductors! Picture a round conductor: Its outer diameter (the surface area) is a fixed ratio to the inner diameter (the conductor's core). Changing one affects the other in a predictably symmetrical fashion.

Now imagine taking that round conductor and flattening it into a thin sheet. The surface area is increased dramatically while the overall gauge (AWG) -- amount of material – remains the same. Thin sheets give us a fixed core size with variable surface area, the most elegant of

solutions. Using thin sheets of conductor we optimize skin effect without changing the core of the conductor by just flattening it as much or as little as required for the perfect blend of surface area to conductor core.

Skin effect is a term used to describe the well-known principle that a signal traveling through a round conductor does so at differing skin depths varying with frequency. High frequencies tend to travel on the outside diameter of the cable, low frequencies travel at the core, so changing conductor diameter affects all frequencies.

In the Purple Rush the skin effect works to our advantage in the midrange because, unlike a round conductor, a flat conductor has no magnetic center. Flat conductors are further optimized because they avoid the build-up of core-traveling bass energy. And in listening tests it appears that flat conductors reproduce the midrange particularly well.

Similarly, regarding high frequency conductors, we want almost no core and all surface area, plus we need to insulate multiple sets of high frequency conductors. The only way to do it is bundling around a round cable. But we increase the surface area of flat cables and reduce their cores in a variation on the midrange solution.

Finally, using DuPont® Teflon™ as the insulating agent is very important because it has a relatively low dielectric constant (compared to air) which means it will constrain the electric field closely around the conductors reducing interference with other conductors' fields.

Features

- All 6 AWG PC-OCC Ohno Continuous-Cast Monocrystal Pure Copper conductors
    - Fine-gauge conductors for the highs
    - Massive solid flat conductor for the midrange
    - Multiple gauges of large-diameter, individually-insulated, solid-core conductors bundled together for the bass
- Quad shielding in silver-clad copper braid
- Advanced cold-crimping and hot spot-welding construction techniques
- 24k gold-plated nonmagnetic solid-billet copper pins and blades
- Connectors machined from solid billet
- Removable ground pin
- Extreme low-noise, high-speed design awarded five separate patents
- Brings a new level of refined beauty, power, dynamics and spaciousness to high-performance systems

Benefits

- Extremely low noise
- Instant current availability

- No dynamic restriction
- Evenly distributed noise cancellation
- High surface area conductors
- Reduced long-grain copper boundaries
- Eliminates ground loops

Shielding

Signal-carrying conductors must be protected from electrical noise generated within the power cord as well as radiated interference from the environment (EMI and RFI). This requires another conductor wrapped around the wire bundles to capture and carry off ground noise. Most connected equipment injects noise back into the power line and that degrades everything in the system. Tight, comprehensive shielding is a must for any power cable in a high-performance system.

Our design philosophy is simple: Effective shielding results in a quieter sonic presentation without forwardness in the presence region or hardness masquerading as false detail. The effect is readily apparent when you listen to a component with and without noise. As silver has the lowest internal resistance of any natural metal, we use two, full-coverage silver-plated copper braid shields to control “skin effect phase-shift” so that the upper frequency signals riding the outer perimeter of the cable arrive at the same time as slower moving signal traveling through the core. This allows for approximately 75% lower phase shift and lower propagation time delay.

Everything You Wanted to Know About Copper Conductors
But Were Afraid to Ask

Typical “normal” high-purity electrical-grade copper has approximately 1,500 grains (or crystals) per foot. The alternating current suffers signal loss and distortion as it crosses these many crystal boundaries on its way through the cable.

OFC

The next grade up is OFC (Oxygen-Free Copper), sometimes called Oxygen-Free High-Conductivity (OFHC) copper. The term is somewhat misleading as OFC copper is not actually oxygen free. It’s cast and drawn in a low-oxygen environment thus reducing formation of copper oxides that cause crystal formation. Oxygen content for OFC is typically around 40 ppm (parts per million) while normal grade copper is about 235 ppm. OFC has around 400 grains or crystals per foot as opposed to 1,500. As there are significantly fewer boundaries to cross the signal is much less degraded with a matching improvement in sound over normal high-purity electrical wire. OFC and OFHC coppers are not all the same and the terms are widely abused. The oxygen content varies in production and is measured within a range of values rather than as a finite amount. Performance levels vary with the quality level of the material, and not all OFC copper sounds or performs the same.

LC-OFC

Moving up a level we find an elongated grain copper sometimes called "linear-crystal" (LC-OFC), "monocrystal", or "long-grain" copper. These coppers are carefully drawn in a process that results in only about 70 grains or crystals per foot. The results are clearly audible; the reduced number of crystal boundaries causes far less grit in the midrange and upper frequencies.

PC-OCC

Professor Atsumi Ohno began the study of the solidification of metals in the mid-1960's and published his landmark book in 1984, *Solidification; The Separation Theory and its Practical Applications*. Professor Ohno describes his many theories and concepts regarding the processing and solidification of molten metals and their resulting crystal structures. He also carefully describes a way to avoid crystal structures entirely that he called the OCC process. First conceived of in 1978 and granted international patents, OCC uses heated moulds in a continuous casting process.

The result are small rods of OCC pure copper, from which wire is drawn that features a single copper grain of over 700-ft in length! A Japanese manufacturer produces OCC under the trade name PC-OCC (Pure Copper by Ohno Continuous Casting), and Purple Rush is constructed entirely of PC-OCC copper.

Conductor Directionality

Over the years we've come to understand that conductor directionality is critical in achieving best performance. In our experience, the direction each conductor is pulled out of the wire machine determines how it will sound in a power or audio cable.

In spite of much debate, we find no doubt that a spool of wire sounds differently when one end or the other is used as the source. All conductors in the Purple Rush are spool-tested at the factory for directionality and then wound into the power cables in the same direction.

Connectors Perfected

As early as 2003 we realized that even with the best conductor technology in the world the connector at either end could be the limiting factor. Most power cord plug prongs are 3-piece construction, simply made from a piece of stamped metal. (The IEC is made the same way). The three parts of the connector are the prongs, the clamp cover and screw. The prongs and clamp are made of brass and the screw of steel. Some companies will plate these parts with gold, nickel or Palladium to improve conductivity and enhance appearance, but shiny plating can't make up for poor build quality.

The Purple Rush prongs are built out of a solid block of high-copper-content, electrolytic brass and polished to remove any surface irregularities, then directly 24K gold-plated.

Hot Spot-Welding and Cold Crimping

Traditional off-the-shelf stock power cords use a tightened steel screw to hold the conductor against the prong but that's prone to oxidation and corrosion as well as loss of connectivity.

Purple Rush employs two forms of welding to fuse the conductor to the machined prongs, cold and hot. Cold-crimping exerts thousands of pounds of pressure squeezing the two metals together with such force that the metal structure of the two pieces actually fuse together. Next, to ensure a perfect connection, we hot spot-weld each of the machined prongs with high-silver-content solder and we've achieved the perfect bond!

Patents

Trio-Metric™ Cable Architecture is completely unique. Patents from the United Sates Patent and Trademark Office have been issued and other patents are pending.

- U.S. Patent No. 7,170,008 (January 30, 2007)
- U.S. Patent No. 7,091,420 (August 15, 2006)
- U.S. Patent No. 7,034,229 (April 25, 2006)
- U.S. Patent No. 6,969,805 (November 29, 2005)