INTERCONNECTIONS

ZIERICK MANUFACTURING CORPORATION WINTER 1999

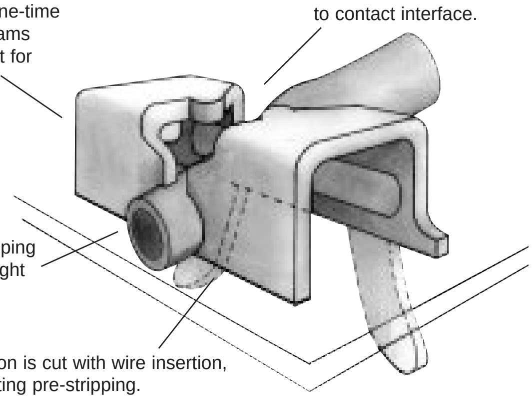
IDCs: Engineering makes the basic. . . better

Insulation displacement connectors (IDCs) are generally accepted as the most cost-effective way to perform wire terminations. There's no wire or cable prep, plus they are ideal for termination of multiple wires in ribbon cable applications. Conventional IDCs are not without limitations, however, notably a lack of durability in demanding industrial and automotive applications, and the inability to perform well with more than one or two wire gauges. As a result, many engineers have, until recently, preferred PCB headers and connectors. Zierick has resolved the issue of IDC reliability, in essence, by turning the problem upside down.

Let's take it from the top. Once the wire connection is made, the further the wire is deformed and the contact beam is deflected, the greater the normal force. It is vulnerable, however, to degrading mechanisms which reduce the normal force essential to a gas-tight connection.

Among the mechanisms that reduce the normal force is creep - the change in deflection or deformation over time with constant force. Creep is also referred to as sizing, which is the reduction of wire diameter due to environmental conditions. Another mechanism is stress relaxation: The reduction in force over time with constant deflection, largely dependent on initial stress level and temperature. Movement between conductor and contact is another mechanism, caused primarily by the wire flexing and pulling and the difference in the coefficients of thermal expansions (CTEs) of the conductor and the contact material. All of these degrading mechanisms work to reduce the normal force and shorten the IDC's service life.

When a conventional IDC-terminated wire moves from shock or vibration, the wire tends to move out from the slot, moving in the direction of least resistance. The short stiff contact beams of the conventional IDC have little deflection, and after wire sizing, the normal force is largely reduced, resulting in diminished connector reliability.



Come visit our web site, www.zierick.com which offers in-depth product information, technical support, and many other features. The address of the site is **http://www.zierick.com**. We are constantly updating and adding to the site to provide our customers with better service and the latest information about interconnection solutions like our new *Catalog 36*. Check it out!

A New Design

Zierick has developed a new generation of IDC terminals that overcomes conventional IDC deficiencies by:

* a separable connection that allows at least 10 mating cycles
* the ability to withstand harsh conditions involving shock, vibration, corrosive gases, and high temperature
* the ability to terminate several wire gauges (stranded and solid) while providing strain relief for the wire.
* the ability to accommodate both automatic PCB insertion and wire termination (with a tool that provides positive wire feedback).

The new Zierick IDC has two front contact beams that are pushed against each other with a preset force called preload. Preload is set by forming the top torsion beams into a curved shape (crown) or by slightly curving the rear torsion beams and the rear base. Minimum contact force, the range of wire sizes, and even wire strand rearrangement can be effectively controlled with the appropriate preload.

This design allows the wire insulation to be cut as the wire is pushed down against the coiled V-shaped shear edges. As the wire is pushed further down, the wire termination slot opens up. This slot can open up to a width larger than the wire diameter without taking permanent set, in order to receive the

Continued on inside page...

Zierick in the Media

Look for Zierick in the November issue of *Electronic Packaging & Production* where Senior Editor Sue Crum has written an article about automated insertion of odd-form components. Zierick's odd-form placement systems receive special mention.

The February issue of *Connector Specifier* will run a case history describing why System Sensor chose Zierick to design a surface mount connector for a smoke detector to be used in HVAC applications.

"Zierick IDC" Continued from cover...

full diameter of the stranded wire. At this stage the terminal beams are in a maximum force/maximum deflection position exerting high normal forces on the wire.

When the wire is moved further downward in the conduit slot, the high normal forces combined with downward movement of the wire will rearrange the wire strands into their narrowest shape. The front contact beams close in on the wire strands and keep them under contact pressure. The wire conduit slot is slightly tapered, widening at the lower part of the terminal where the angle of taper can be adjusted by setting the preload correctly. The preload is larger near the insulation shear edges.

Turning the situation rightside up

The conventional IDC requires an increasingly large force to push the wire all the way down in the slot because the wire gets tighter and tighter. Consequently, when there is wire movement from vibration, shock, or temperature, the wire tends to move upward out of the slot - the direction of least resistance. In a Zierick IDC terminal the wire insertion force is increased to the maximum, the insulation is cut, and the wire opens up the wire slot. From this maximum level the wire insertion force will rapidly decrease to a minimum level as the wire is pushed down into the slot - a snap-in effect - an effect that is exactly opposite on a conventional IDC! Under duress, the wire strands in a Zierick IDC move downward where the slot is slightly wider. The lower end of the slot is closed off by the surface of the PCB so the wire strands cannot leave the slot.

In short, the Zierick IDC is a comprehensively more effective method of achieving wire connection.

ASK THE EXPERTS

Q: I need to put a surface mount gold-plated pin onto my printed circuit board. What kind of problems will I run into when I solder it?

A: The current Zierick line of surface mount pins are plated with 150µ" of satin 95% tin/5% lead over 100µ" of copper. In most of our present applications, this plating is suitable because both the base and post sections of the pins are soldered. Some applications, however, require plating which will do more to prevent corrosion and offer a low contact resistance on the post section while allowing for solderability on the base. Gold plating is a good solution for these requirements, but there is a hesitancy to use it for fear that gold intermetallics may form in the solder joint, making it brittle and unreliable over a period of time.

In his book, *Solders and Soldering*, section 3.17 "Intermetallic Crystals, Joint Embrittlement, and Loss of Solderability," Howard H. Manko states that, " It is necessary from time to time to apply gold plating to surfaces (usually contacts) that are also soldered. Here we must take special precautions. We apply only 35 to 50µ" of gold to the surface. The concept here is simple: We provide so little gold that even if the solder dissolves it all, no joint embrittlement would result in the average joint." Other experts in the field agree with Manko.

Based on information from independent plating companies, it is not feasible to selectively plate gold on the post and tin/lead on the base of the pin because the tin/lead froths and contaminates the gold in the final plating process. An alternative approach, which seems to be gaining popularity in the last ten years, is to use 20µ" of palladium over the nickel, then 3-5µ" of gold flash over the palladium just on the post. The palladium offers no intermetallic problem in the solder joint, solders well, offers a corrosive barrier to the nickel, and has good wear qualities. The gold flash enhances lubricity and also lowers contact resistance.

Recommendations

For customers who do not have stringent pin contact requirements, our present tin/lead over copper plating method is satisfactory. For customers who accept that a 40µ" gold plate over 50µ" nickel on the base does not degrade the solder joint, we can meet their requirements. For customers who will not accept gold on the base of the pin, we can recommend 20µ" pure palladium over 50µ" nickel with a 3-5µ" selective gold flash on the post. Our plating experts can help you find a solution to this problem - one that will fit your unique situation.

Ron Fredriks is a senior Research and Development engineer with Zierick. He came to us from IBM with twenty-five years experience as an electronic packaging problem solver. In the past five years, he has helped develop our surface mount terminals and their automation. He is an expert in process development and in resolving plating problems.

Stable-Lok™ Quick Disconnect Terminals stay ahead of their time

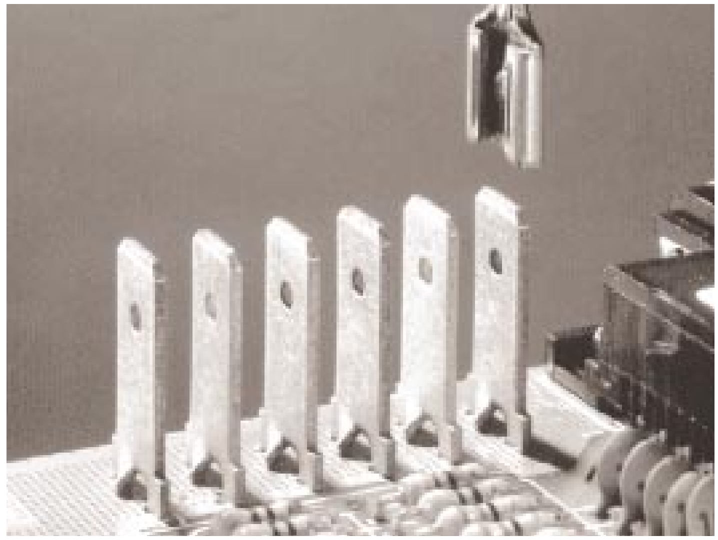
Over the years, many designs have been offered for printed circuit board (PCB) mountable quick disconnect terminals. The most common of these usually include a mating segment that is manufactured in accordance with NEMA and UL standards with two parallel mounting legs intended to be received within two spaced holes that are pre-drilled in the PCB. Although the terminals are normally made from relatively thick metal stock, usually 0.020" or 0.032" thick, the mounting legs have a generally small cross-section and are susceptible to fatigue and failure.

Searching for solutions

In order to overcome the disadvantages of the typical terminal, which is likely to bend or fracture due to forces applied to the planar or flat surface (such as those introduced with mating to a quick disconnect receptacle), the industry developed several design modifications to minimize terminal deformation and breakage.

The obvious solution would be to increase the mounting leg's cross-sectional areas in an effort to strengthen them. Due to NEMA, UL, and industry standards, however, both terminal thickness and mounting hole diameters are difficult to alter. Furthermore, thicker terminals, requiring additional material, would add cost to an already price-sensitive industry.

It becomes clear that increased strength to improve terminal and PCB quality and reliability must be approached as a function of design rather than of materials. One such design included a central mounting leg with a pair of stabilizing arms. The central problem remained, however, because costly metal is added on each side of the terminal. Plus this design required additional space on the PCB to accommodate the outward projections. Finally, the single central mounting leg of this design exhibited poor deformation resistance when subjected to torque - adding a further failure mode not encountered with terminals of the traditional design.



Enter Zierick

To overcome the disadvantages of both typical and modified terminal designs, Zierick introduced the Stable-Lok™ - a design that eliminates tensile strength concerns without significantly increasing material requirements and without taking up additional space on the PCB.

The design of the Stable-Lok™ quick disconnect uses the divided lower flat area of the terminal to provide non-linear stabilizing points between the mounting legs. These points extend in opposite directions relative to the main body of the terminal and define offset or pressure points. The pivot points rigidify and stabilize the terminal in relation to the PCB and create resistive torque that minimizes the chance of breakage to the mounting legs.

Less tension is generated on the legs due to the longer moment arm from the legs to the pivot point. The stabilizers make contact with the PCB at the pressure points and are most effective when formed into an arch or "domed" shape and located as far from the terminal's center plane as possible, typically two times the material thickness.

Tests on the Zierick terminal show that resistance to side forces increase by a factor of more than two. Our terminal requires no more material than a typical terminal and uses minimal real estate on the board. And since construction of the stabilizers uses the material portion from between the terminal mounting legs, the stabilizing elements do not interfere with the inclusion of an integral carrier strip in continuous chain format.

Once again, Zierick has established the industry standard.

NEW AT NEPCON

Zierick will introduce a new surface mount pin header and an entirely new model 9700 semi automatic terminal insertion system at Booth #4387 at NEPCON West in Anaheim, CA, this February 23-25. Even if placed off center, this header assembly is pulled into proper position, drawn by the capillary action of its advanced design. Coplanarity problems are eliminated, and a much stronger solder joint produces 50% higher retention force than J-Lead headers. Plus, the solder ring formed around the pin at the top side of the header assembly is visual indication that the reflow process is complete. AND DON'T MISS . . . Janos Legrady will present his paper *How to Improve Surface Mount Components and Packaging with Capillary Action* at TS 19 Case Studies in New Procedures for the Soldering Process on February 23 at 9:00 am.

See you there!

Access the Zierick Reference Library

Please check literature you would like to receive.

- ☐ Catalog 36, Surface Mount & Through Hole Interconnection & Assembly Solutions
- ☐ Catalog 33, Interconnection Hardware
- ☐ Through Hole & Surface Mount Interconnection Capabilities
- ☐ Through Hole Assembly Solutions, Assembly equipment to Meet All Your terminal Insertion Requirements
- ☐ Surface Mount Technology
- ☐ Video, Zierick Manufacturing Assembly Equipment
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