Coil Formers in Today's Electronic Manufacturing Environment

A White Paper by MH&W International

MH&W International has been the supplier of coil formers from several sources throughout the past 52 years. The primary source of our coil formers has been TDK Corporation, NORWE and Schwartzpunkt. In 2010, TDK announced the termination of their activities with regards to the coil formers they supplied. Now in 2016, Schwartzpunkt has also announced they will discontinue production of coil formers. Other manufacturers of coil formers, supplying products to other ferrite companies, have also stopped production of their coil formers. In additional, Phillips Chemical, the primary source of high temperature Ryton plastic materials, recently discontinued the production of most of their Ryton materials including the Ryton R4, used in many of the old TDK Coil formers and the Ryton R7, a PPS used heavily in Taiwan/PRC.

Since 2010, MH&W has been on a mission to find alternate/replacement manufacturers for our line of coil formers with the primary country of origin being in Taiwan/PRC. This paper describes the difficulties and challenges that MH&W has experienced in converting to available technologies.

Coil Former Material

Phenolic:

There are many varieties of phenolic materials in Taiwan/PRC for coil formers. However, there are three (3) materials that are commonly used. These materials are T375J (Chang Chung Plastics), PM9820 (Sumitomo) and PM9630 (Sumitomo). These three materials relate closely with the Vyncolit X611 which is the dominant phenolic material in Europe. The biggest difference in these materials is cost and quality/strength. Below in *Figure 1* is a comparison of a few of the physical properties;

	CHANG CHUNG	SUMITOMO	SUMITOMO	VYNCOLIT
	T375J	**PM 9820**	**PM 9630**	**X611**
FLEXURAL STRENGTH	13100 psi	17800 psi	27200 psi	28300 psi
COMPRESSIVE STRENGTH	27600 psi	32600 psi	36900 psi	39200 psi
IMPACT STRENGTH	1.7	3.5	4.3	5.8
DEFLECTION TEMP UNDER LOAD	356°F	410°F	572°F	406°F
V0 FLAME RATING FLANGE THICKNESS	0.0188 inch	0.0169 inch	0.0150 inch	0.0591 inch

Figure 1 - Comparison of Phenolic Materials

The T375J is the least costly of the phenolic materials that we have seen. However, some of our customers have had problems with the material on their production line. The problems were severe enough that our customers de-authorized the T375J as a coil former material. Those times when MH&W has a choice of materials, we pick the PM9630 for its strength and higher level of quality.

PPS – Polyphenylene Sulfide

PPS is a very high operating temperature thermoplastic material. History shows the material to be Ryton R4 and R7 produced by Phillips Chemical. Some of TDK's coil formers were made in PPS; specifically, the LP coil

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formers and the PQ coil formers ending in "0114" or "0112". The materials were discontinued a couple of years ago leaving manufacturers with an inventory of coil formers and plastic pellets in the Ryton materials. The difficulty here is that these Ryton materials became delisted at U.L. when the materials became obsolete. The replacement material is the Toralina materials from Toray Industries. NORWE, Germany has qualified the A504X90 natural (UL E41797) for their replacement. Win Shine is qualifying the A310MX04 (UL E41797).

Coil Former Specifications:

When reviewing the internet drawings of coil formers from various manufacturers, you will notice there is no standard format for what information is presented. Some manufacturers list the coil former material generically (phenolic) and some manufacturers list the specific material (PM9630). Some list the pin length, some don't. Some list the standoff distance, some don't. Some list the tolerances, some don't. Some list the pin material, some don't. Some list the pin plating, some don't. Some manufacturer's drawings may indicate a part number but upon further investigation, the drawing is actually for a different ferrite core. Example, there is a difference in ferrite cores between an EE20, an EF20 and an EM20. MH&W International produces our own drawings insuring that all the information we can obtain is on the drawing.

And one observation here, between the coil formers produced in Japan, those produced in Taiwan and those produced in the PRC, there is no exact duplication. As an example, for a coil former for a PQ26/25 ferrite core, there are no two coil formers produced by any of the manufacturers that are exactly the same. There are differences in dimensions such as pin row-row, pin-pin, pin pitch, stand-off, flange thickness and of course tolerances. In addition, MH&W has custom tooled several coil formers to match the TDK dimensions. But because of the differences in manufacturing technologies between Japan and PRC, there were small differences even in those custom tooled coil formers.

Pin Plating:

The RoHS directives removed the lead from the pin material and the pin plating. As a result, the configuration of pins is, usually, either:

1. Steel Wire (CP) with a nickel (Ni) barrier and an electroplating of 100% Sn.
2. Phosphor Bronze (DS) with a nickel (Ni) barrier and an electroplating of 100% Sn

There are two forms of the Sn that are used in Asia, matte Sn and bright Sn, matte Sn being the more common. The differences are;

1. Matte Sn – lower shelf life, inconsistent coverage
2. Bright Sn – tendency to whisker

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MH&W has an agreement with one of our suppliers to provide through-hole coil formers with a CuSn plating, a composition of ~2-3% Cu. This increases the shelf life and reduces the soldering temperature. Another of our suppliers does a secondary process as an option to re-dip the finished coil formers to increase the shelf life.

Since 2010, MH&W has been able to offer drop-in replacements/near equivalents to approximately 90% of the old TDK coil former offerings. We also have custom tooled coil formers for several of our customers. We have a Boutique Style offering for coil formers whether standard or custom. Give one of our Customer Service Rep's a call when you have requirements for coil formers.

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