Since successfully addressing the well publicized issues created by the RoHS and WEEE directives on the restriction of hazardous substances, the connector industry is now facing a new challenge — Glow Wire. Although the IEC 60335-1 standard is primarily relevant in Europe, North American companies need to comply in order to service their global customers.

IEC 60335-1 was quietly put together in 1998, although its effects have only really become apparent since mid-2006. In the past, the emphasis was on the ability of electrical appliances and components to self-extinguish in accordance with the Underwriter Laboratories (UL) standard in the event of a naked flame. However, damage is now increasingly being caused by devices self-igniting when components malfunction — damage that may occur in particular when appliances are left unattended.

Because IEC 60335-1 describes the “Safety of Household and Similar Electrical Appliances,” it is primarily about protecting end users and has also been adopted as a basic standard by well-known consumer protection organizations, such as the CE mark. Even the CCC mark, established in China, refers to IEC 60335-1.

Looking at the history of the standard, one can understand why there is now some urgency to its adoption. The standard’s origins go back to 1991, but led to lengthy discussions and objections. In fact, it was not passed until 2005. Consequently, during this time, appliance manufacturers were effectively excused from complying with the standard. Now, however, the uncertainty no longer exists, and appliances must conform to the standard and the resulting test procedure, which was defined under IEC 695-2-1.

With regard to connectors and wiring, the standard requires that insulation materials (connector housings, conductor insulation and printed circuit boards) in all circuits carrying more than 0.2 A be able to resist ignition in the event of glow-wire overload. A distinction is made between attended and unattended appliances.

Annex O.2 to IEC 60335-1 provides an overview. (See Chart 1.)

Unattended vs. attended

There is a mandatory test procedure for carrying out glow wire tests. The temperature of the glow wire
is calibrated and the test is carried out at intervals of 25 DegC. A product is therefore passed at 750 DegC if the material ignites only at 775 DegC.

Therefore, for all unattended appliances with a current load on contact above 200 mA, Paragraph 30.2.3 requires that:

- Either the plastic material has a GWFI (Glow Wire Flammability Index) in accordance with IEC 60695-2-12 of 850 DegC, or
- The plastic material has a GWIT (Glow Wire Ignition Temperature) of 775 DegC in line with board testing according to IEC 60695-2-13, or
- The tested connector body does not ignite at a glow wire temperature of 750 DegC (and/or burns < 2 seconds).

If, however, the connector body does ignite at 750 DegC, all the parts surrounding the connector must either withstand a needle flame test, or comply with UL94 V-1, or better.

For all unattended appliances with a 200 mA current load or less on contact (also paragraph 30.2.3), the following applies:

- Either the plastic material has a GWIT (Glow Wire Ignition Temperature) of 675 DegC in line with board testing according to IEC 60695-2-13, or
- The tested connector body does not ignite at a glow wire temperature of 650 DegC (and/or burns < 2 seconds).

If, however, the connector body does ignite at 650 DegC, all the parts surrounding the connector must either withstand a needle flame test or comply with UL94 V-1 or better.

According to Paragraph 30.2.2, the following applies for attended appliances:

- At a current load above 500 mA, the connector body does not ignite at a glow wire temperature of 750 DegC.
- At a current load of 500 mA or less, the connector body does not ignite at a glow wire temperature of 650 DegC.

In addition, according to Paragraph 3.2, all printed circuit boards in low-power appliances which are not handheld, such as tabletop or floor-mounted appliances, must meet UL-94 V-0 and withstand the needle flame test.

### Supplier solutions

Suppliers of plastic materials have developed new products that meet these requirements. The connector industry is demanding that these new plastics have the same attributes (in terms of processing and shrinkage factors) so that they can be processed in existing injection molds.

If existing injection molds had to be retooled due to different processing parameters, those additional costs plus the higher costs of plastics would inevitably impact connector prices and thereby make end products more expensive. The plastics industry offers a range of GWIT products for PA-based materials, but for PBT-based products the choice is more limited.

All of this would be tolerable if the test methods produced unambiguous results. For example, housing wall thicknesses play a crucial role in test strategies. One might wonder which direction and which surfaces are to be used for the glow wire test. On some plastics, gas emissions that ignite during the glow wire test can lead to different assessments, even at professional test centers. For these reasons, connector manufacturers and appliance manufacturers have upgraded their test laboratories to obtain a clear overview for themselves. The bottom line, however, is that only statements from an independent test laboratory count.

Unfortunately this situation has not been fully clarified fully by standards bodies. Everyone involved complains that a test interval of 25 DegC is too narrow. (In other words, if a material does not ignite at 750 DegC, but ignites at 775 DegC, it has withstood 750 DegC). Additionally, test equipment must cool down during the test procedure in order to obtain clear results.

Molex is endeavoring to successively examine all connectors deployed in this area in accordance with IEC 695-2-1. For example, the Sabre (7.5 mm pitch), MLX (6.35 mm pitch), KK (5.08 and 3.96 mm pitch), SPOX (5.08, 3.96 and 2.5 mm pitch), RAST (5.0 and 2.5 mm pitch), Mini-Fit (4.2 mm pitch) and Micro-Fit (3.0 mm pitch) connectors will all be adapted to meet the requirements of IEC 60335-1 by using better plastics. In that case, there will be more new part numbers, new approvals, and new entries into customer parts lists, much to the chagrin of those affected, but at least going in the direction of consumer safety.

Additional measures must be implemented for connectors with a non-compliant GWIT, such as metal coverings or firewalls, in order to ensure that the appliance does not ignite in the event of an overload. All parties are duty-bound to exercise discipline and fairness to provide consumers — those who are ultimately affected — the plain truth.