

- ❑ The Waste from Electrical and Electronic Equipment (WEEE) & Restriction of Hazardous Substances (RoHS) are European directives that became effective on July 1, 2006. With a focus on improved public health and environment, the principles of these directives are rapidly gaining worldwide acknowledgement and acceptance as other countries continue to adopt similar versions. It is now probably safe to say that it is just a matter of time before WEEE & RoHS compliance becomes a global standard.
- ❑ Originally, WEEE was developed to control the amount of certain hazardous substances ending up in landfills.
- ❑ WEEE sets forth minimum recycling guidelines for producers of Electrical and Electronic Equipment (EEE). WEEE requires you to register your product and implement a plan to recycle in each EU country. Each county has different systems and requirements.
- ❑ Before long, it became evident that only controlling the waste stream was not going to be enough. Something had to be done with regard to the origin of products containing these hazardous substances.
- ❑ As a result, RoHS was born with the intent to control the amount of certain hazardous substances in new products.
- ❑ The RoHS Directive was created to restrict the use of certain hazardous substances in the manufacturing of new EEE products. This directive specifically governs the following substances:
 1. Lead (Pb) – found in solder, batteries, electronics, paints, etc.
 2. Mercury (Hg) – lamps, sensors, relays, thermometers, etc.
 3. Cadmium (Cd) – batteries, glass, ceramics, corrosion resistant coatings found on hardware & fasteners, etc.
 4. Hexavalent Chromium (Cr +6) – chrome plating, leather tanning agents, hardware, etc.
 5. Polybrominated biphenyls (PBB) – flame retardants used in plastics and circuit boards, etc.
 6. Polybrominated diphenyl ethers (PBDE) – flame retardants used in plastics and circuit boards, etc.

The maximum allowable level found in a homogeneous material (e.g. metal, glue, paint, plastic, wire, solder, etc.) cannot exceed the levels found in Table 1. These levels are controlled by the European Union and are subject to change.

Table 1: Maximum Concentration Values*	
Substance (or compound containing substance)	Maximum Concentration value in a homogeneous material % by weight or (ppm)
Lead (Pb)	0.1% by weight/1,000 parts per million (ppm)
Mercury (Hg)	0.1% by weight/1,000 ppm
Cadmium (Cd)	75ppm**
Hexavalent Chromium (Cr +6)	0.1% by weight/1,000 ppm
Polybrominated biphenyl (PBB) flame retardants	0.1% by weight/1,000 ppm
Polybrominated diphenyl ether (PBDE) flame retardants***	0.1% by weight/1,000 ppm
<p>*These maximum concentration values are specified in the RoHS Directive, as amended by EU Decision 2005/618/EC. **The number 75ppm comes from the Denmark Statutory Order No. 1199 of December 23, 1992. This Danish law is more stringent for cadmium concentrations for unintentional uses than the EU Directive on the Restriction of the Use Of Certain Hazardous Substances in Electrical and Electronic Equipment. ***As of August 15, 2004, the European Union has prohibited placing on the market any substances, preparations, or articles or flame retardant parts thereof that contain either of two types of PBDEs (pentabromodiphenyl ether and octabromodiphenyl ether) at more than 0.1% by mass. Directive 2003/11/EC, Official Journal of the European Union 15.2.2003.</p>	

- ❑ The term ‘homogenous material’ is a critical term with respect to the RoHS Directive. As a result this term must be clearly defined and enforced with authority. A homogenous material is the unit that cannot be mechanically disjointed into different materials or any material that isn’t mechanically divisible (disassembled, cut or ground) into separate material constituents. Mechanically disjointed means the materials can be, in principle, separated by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes. For example, a plastic cover is a “homogeneous material” if it consists of one type of plastic that is not coated with or has attached to it or inside it any other kinds of materials. In this case the limit values found in Table 1 would apply to the plastic. An electric cable that consists of metal wires surrounded by nonmetallic insulation materials is an example of a “non homogeneous material” because the different materials could be separated by mechanical processes. In this case the limit values found in Table 1 would apply to each of the separated materials. A semiconductor package contains many homogeneous materials which include; plastic molding material, tin-electroplating coatings on the lead frame, the lead frame alloy and gold-bonding wires.
- ❑ There are no viable “drop-in” solutions when moving to RoHS compliance. Beware of those claiming to have one.
- ❑ IPC-Association Connecting Electronics Industries®, the industry recognized standards body for electronics assembly, has endorsed SAC305 as its preferred lead-free solder alloy. SAC is an acronym stemming from the Latin names for tin (Sn), silver (Ag), and copper (Cu). The 305 equates to the percentages of each element within the alloy, specifically, 3.0% silver, 0.5% copper, and the remainder being tin.
- ❑ SN100C, a near pure tin alloy with traces of nickel and copper, is another common lead-free alloy. It is quickly gaining popularity as a lower cost alternative that produces cosmetically shinier finished solder joints, but comes so at the cost of even higher processing temperatures than those associated with SAC305.
- ❑ Some key factors to remember when specifying components are:
 - Most lead-free solder alloys require higher processing temperatures than their leaded counterparts. To put this into perspective, consider the tin/lead solder alloy that was most commonly used in electronics. Comprised of 63% tin and 37% lead, this solder alloy becomes liquidus @ 183°C. For comparison sake, SAC305 and SN100C alloys become liquidus at 217-219°C and 227°C, respectively. This is 34-44°C higher temperature for lead-free. Although lower temp lead-free alloys do exist, they often don’t support the integrity and reliability of the finished product.
 - Lead-free doesn’t necessarily equal RoHS compliant. RoHS covers more than just lead. Other ingredients may exist in portions that are not considered RoHS compliant.
 - Ingredients that are lead-free by RoHS definition don’t necessarily mean they can withstand the temperatures associated with lead-free soldering processes. The same thing goes for RoHS compliant ingredients. Just because they meet the criteria for RoHS doesn’t mean they can take the heat.
 - Therefore, more information is required for each component, such as:
 - Is it lead-free?
 - Is it RoHS compliant?
 - What are the component leads or BGA balls made out of?
 - What is the surface finish on the PCB?
 - Can it withstand both automated reflow & wave solder processing temperatures?
 - Reflow >217°C for 90 seconds with a maximum temperature of 260°C.
 - Wave solder maximum temperature of 260°C for at least 5 seconds
 - Can it be washed?
 - What is its Moisture Sensitivity Level (MSL)?

- ❑ RoHS is a “self-declaration”. RoHS compliance will require due diligence, specifically an investigation of process to ensure adequate preventative checkpoints exist, are well known, and are being used to control the supply chain and production.
 - RoHS compliant Bill of Material – all components declared RoHS free by supplier(s)
 - RoHS compliant manufacturing process with adequate checkpoints – TDP is compliant.
- ❑ TDP has designed and developed RoHS compliant products for numerous customers in a variety of industries. TDP wants to provide this service to you.
- ❑ TDP has also developed RoHS compliant contract manufacturing processes that are proven capable of producing RoHS compliant products successfully. TDP also wants to provide this service to you.
- ❑ TDP has also helped customers transition products towards RoHS compliance, yet another service TDP can provide you.
- ❑ A ‘*Customer Information and Design Rules for Product Designers*’ booklet and checklist are available upon request. TDP is making this available to help educate customers on a variety of issues often seen in contract manufacturing that make products more difficult and more expensive to manufacture. Ask your TDP salesperson or program manager for a copy.
- ❑ The internet holds a wealth of information regarding RoHS & WEEE. Here are but a few links to get more information:

www.pb-free.com
www.leadfree.org
<http://www.dti.gov.uk/sustainability/>
<http://www.newark.com/services/rohs/index.html>

- ❑ Reference Documents:

Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC of the European Parliament
Restriction of Hazardous Substances (RoHS) Directive Amendment 2005/618/EC of the European Parliament