

Foreword

If you were shopping for electronic equipment and saw the label on an appliance, “Built using equivalent-to-new (ETN) components”, would you hesitate to buy that product? Consider the fact that more and more products and their components, many of which are still perfectly good, find their way into the waste stream although they could have had further “lives”. Only a few industrial manufacturers, for example, in the copier and medical industries, make use of the tremendous potential of ETN components to protect our environment. Perhaps you are one of the majoring manufacturers who are still hesitating, perhaps because of allegedly unsolved technical, economic, legal, or other issues of reuse. The subject of this book relates to those issues and how to solve them.

Many manufacturers have concerns that include whether or not their customers will accept or trust the quality of reused components. The costs to them, in both time and money, must not outweigh the benefits of gaining the consumer’s trust. It is also of utmost importance to avoid any risk to the environment that reuse may cause.

The authors of this book initiated the international standard IEC 62309 and it was enhanced by a team of internationally accepted experts. Their objective was to demonstrate practical procedures for the problems of the reuse of electrical and electronic (E&E) products and their components. IEC 62309 considers the terms “new product”, “equivalent-to-new”, “overall lifetime”, etc. from the standpoint of reuse and it redefines them, where necessary, for this purpose. This book is about the content and application of IEC 62309, that is, it tells how to operate with the standard, explaining the steps from the removal of the ETN components out of a used product through the sale of a new product incorporating these components.

Goals and structure of the book

The focus of the book is how used components are to be qualified so that they can be assembled into new products. Indeed, a large number of components can be refurbished to fulfill all the criteria of a new component in terms of quality and planned service life. The authors have the following goals:

- to define technical criteria for decision-making involving the reuse of components and to designate guidelines for product improvement;
- to define economic criteria for decision-making regarding reuse;

- to explain the requirements of relevant European environmental legislation and normative background for reuse;
- to make readers familiar with IEC 62309 and to explain it with examples drawn from practice;
- to consider also peripheral aspects, such as the software embedded in components and products to be reused.

Reuse should start as early as the development process because the quality and reliability of products with reused components may in some cases even be better than that of products consisting only of new components! The reason is that the reused components, besides their former quality tests as carried out during the starting manufacturing process, have also passed a successful period of practical testing, namely during their usage in their former life. Also the so-called early failures are overcome.

The philosophy of *equivalent-to-new (ETN)* concept is one of the key aspects of this book and will be explained in detail in Chapter 1. The first chapter also introduces the terms used, and discusses economic and technical aspects. Reuse can only be deemed successful if it is accepted by customers, who, ideally, would be given complete information about the existence and quality of such components contained in the product they buy. However, this might not be necessary if the product is completely qualified and found to be equivalent to a product containing only new components. If this state will not be achieved reliably it must be clearly declared which part of the product contains reused components. This reveals the likely risks and enables the customer to understand that the manufacturer is aware of his/her liability and thus has carried out a careful qualification process. The tests of the components to be reused are only the beginning of an overall risk prevention process. In addition, the requirements of governmental, industrial, and non-governmental organizations for consumer protection, product liability, and environmental protection have to be complied with. The first chapter summarizes these important aspects, considering also legislative standards.

Criteria for the identification and qualification of components for reuse and quality aspects form the content of Chapter 2. By applying the principle of ETN to used components, a simplification in quality testing arises because all characteristics should be equal or similar to those of new components and the same is valid for quality testing. For components with undefined, i.e., non-ETN state, new test procedures or limiting characteristics would have to be defined and would require more work. Also, the technical limitations of reuse have to be determined and overcome. Legally and technically sound arguments have to be combined with a proper, well-structured communication between all participants. The history of the ETN components within their entire life cycle must be known including the information about their technical and quality status. These aspects form the

content of the Chapters 3 to 5. Different reuse strategies are also described in Chapter 5 which include all values situated in a product, i.e., residual value of the used product, values of ETN and used components, and material values and possibilities for re-marketing. Chapter 6 contains considerations for reuse of software in ETN products. Chapter 7 summarizes the chapters before and discusses future developments aspects to be expected.

Audience and perspectives

Potential readers the authors expect build a diverse, inhomogeneous group of people from engineers to academics, coming from supply chain management to governmental executives as outlined below:

- *Managers* who want to be informed about the chances and challenges of component reuse and the present situation in the industry. They may be planning their own recycling strategy.
- *Product planners* and *design and development engineers* who have to select and integrate used components in new products.
- Members of the complete *supply chain* who are part of the value-added chain and want to reduce costs.
- *Purchasers* in government departments and industry, quality and environmental engineers, customers, manufacturers or sales people who like to get solid knowledge about cost saving potentials, risk avoidance and legal relationships. The readers belonging to this group may also be interested in background information about dependability aspects of reuse;
- *Students of all disciplines* with interest in environmental and/or quality science.

In the next decades, the international pressure on manufacturers to reuse will for sure increase because of the high ranking position of reuse in the hierarchy of waste-preventing requirements as described in the waste legislation norms, that are, Waste Framework Directive and Directive on Waste Electrical and Electronic Equipment (WEEE) both of the European Union. The chances and benefits of reuse, not only for the environment might be high, especially with mass products. Experience shows that about 25 % of the components of the E&E products are suitable for reuse. Additionally, reuse will open new areas for leading edge activities for many industrial fields and create new jobs.

The authors would be glad if this book will help to guide and accelerate this technical, economic, and ecological process and navigate it in the right direction.

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