

An Overview of Used-Products Remanufacturing

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Abstract

Remanufacturing is an important production activity, which is mainly driven by the increasingly strict environmental regulations imposed by governmental bodies, growing customers' awareness of green environment and potential economic benefits of remanufacturing. In this paper, the key motivating factors for companies to engage in remanufacturing program are examined. The major sources for acquiring used-products and the subsequent markets for selling remanufactured products are also examined. More importantly, the generic-key remanufacturing processes are examined and the corresponding unique characteristics are highlighted. Four examples of remanufacturing process of different products are presented to demonstrate that exact number and sequence of remanufacturing process largely depended on the type of product being remanufactured. In sum, this paper presents an overview of used-products remanufacturing, which in many ways would benefit the general public, environment, manufacturers/remanufacturers, as well as researchers.

Keywords: used-products, remanufacturing, product recovery

1. Introduction

Recently, remanufacture of used/worn-out/broken products has become a vital part of production activity in many companies (Ferrer & Swaminathan, 2009; Schulz & Ferretti, 2011). The automotive sector particularly has a strong and long history of remanufacturing (Seitz, 2007; Golinska, & Kawa, 2011) where the alternator has the highest remanufacturing rate (Schau, Traverso, & Finkbeiner, 2012). Remanufacturing is also gaining scientific significance in a variety of industries that include single use-devices for hospitals, such as wheelchairs and hearing aids (Srivastava, 2004) cellular phones (Guide Jr, Jayaraman, & Linton, 2003b) and truck tyres (Lebreton & Tuma, 2006). The diverse nature of remanufactured products together with different degrees of remanufacturing efforts creates a variety of applications (Zikopoulos, 2012). At one end is the direct re-use of slightly used commercial used-products, to the high-touch remanufacture of expensive modules, which are reassembled in complex new products, at the other end.

Remanufacture of used/worn-out/broken products (remanufacturing), refers to an industrial process in which used/worn-out/broken products (henceforth called used-products) are transformed into "new products" (Lund, 1984b). Hereafter, these "new products" are referred to as remanufactured products to distinguish them from a completely new product. Generally, any manufactured products or devices can be remanufactured, provided that these are discarded used-products with lower materials and components reprocessing costs compared to the market value of remanufactured items (Lund, 1984b). Also as outlined by Hauser and Lund (2003), used-products must be; (i) durable products, (ii) products that fails functionally, (iii) standardized products with interchangeable parts, (iv) products with high remaining value-added, (v) products with low acquisition cost, (vi) products with stable technology, and (vii) customer awareness of the remanufactured version.

Remanufacturing process could be sometimes confused with other similar activities such as repairing, refurbishing and reconditioning. Repaired, refurbished and reconditioned products are very close to remanufactured ones and these terms can regularly be considered synonymous with each other (Ijomah, McMahan, Hammond, & Newman, 2007b). Though these terms have similarities, however in term of functionality and performance, the weightage and meanings are different. For example, repairing is described as corrections of specified faults in a product;