

'Wear' and 'wear parts' in contextual relation with 'obsolescence'



Dr. Mathias Woydt, MATRILUB, and
Rolf Luther, Gesellschaft für Tribologie e.V., Aachen
 Summary of the position paper of the German Society for Tribology e.V.

Introduction

Everyone thinks they have a clear idea of what the term "wear part" means, but that does not necessarily mean that everyone's understanding of the term "wear part" is the same as everyone else's. There is good reason for this, as, perhaps surprisingly, there are still no standard definitions.

The extension of service life, avoiding planned obsolescence, and, generally, the manufacture of more sustainable products contributes significantly to material efficiency, which translates into resource conservation and to energy efficiency. The concept of durability/service life is represented by the features of longevity, reparability and ease of maintenance of the product.

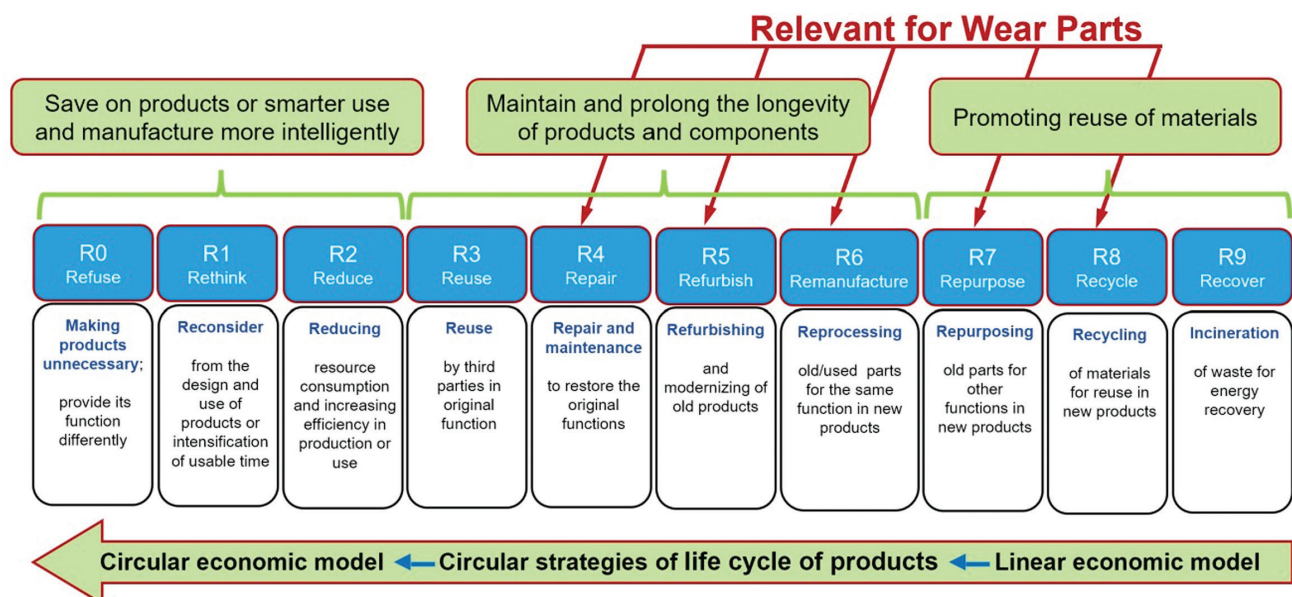


Figure 1: The 9R framework showing circular economy strategies to extend product life through durability, repair, reuse, and recycling.

As part of the European Green Deal, the European Commission introduced a new “right to repair” (EC/2024/1799) in the framework of an Action Plan for the circular economy. The term “wear part” appears more frequently in the context with the Ecodesign Directive (e.g. EU/2024/1781). This term must be distinguished unambiguously from the term “wear”. While “wear” is clearly defined within the framework of tribology and lubrication sciences, the

term “wear part” must be redefined and delimited in order to avoid possible misuse. Additionally, the terms “durability” and “longevity” are defined in the European Sustainability Reporting Standard (ESRS, EU/2023/2772) and are part of the objectives of the EU Taxonomy - Regulation EU/2020/852, which provides a number of attributes relating to “wear protection” as follows:

Objectives

Article 13 (EU/2020/852)

- (1) An economic activity makes a significant contribution to the transition to a circular economy, including **waste prevention**, reuse and recycling, if:
- a) It uses **the natural resources**, including bio-based and other raw materials of sustainable origin **more efficiently** in production, e.g. through
 - i. **reduction in the use of primary raw materials** or an increase in the use of by-products and secondary raw materials; or
 - ii. **resource and energy efficiency measures**;
 - b) It improves the **durability**, repairability, upgradability or reusability of products, in particular in design and manufacturing activities;
 - e) Prolongs the use period of products, also through reuse, **design for longevity**, refunctioning, disassembly, remanufacturing, modernisation and **repair**, and sharing of products;
 - k) **Avoids or reduces waste**.

Attributes and contributions of tribology

Wear protection = technical longevity and service life extensions reduce the amount of waste produced.

Bio-lubricants and lubricants from biogenic resources; bio-plastics.

Wear protection = material efficiency and resource conservation.

Energy efficiency due to friction reduction and resource efficiency through wear protection lead to CO₂ reduction.

Longevity through wear protection reduces waste volumes and resource consumption.

Low-wear tribological systems and their remanufacturing conserve resources with the embedded CO₂ footprint.

Longevity, repairability and refurbishment reduce waste volumes.

In the Taxonomy regulation EU/2020/852, the “inefficiency in the use of materials”, including the lack of wear protection and reparability, is classified as an economic activity significantly impairing environmental objectives (Art. 17(1) d) i)). Wear protection and increased longevity are core strategies for the prevention of waste and reduction of embedded CO₂ footprint.

In such a context, terms like service life, durability and life span are essential to identify the capability of a part or a product to function as required under defined conditions of use, maintenance and repair until a limit state is attained. Under consideration of customer or market requirements and the technical complexity of the product, this “service life” is determined in advance.

Direct reuse, comprehensive refurbishment, and remanufacturing are among the value retention processes additionally extending the potential useful life of a product beyond the traditionally expected life span.

The G7 Toyama Framework on Material Cycles focuses on Value Retention Processes (VRP) and is fine-tuned with the current objectives of resource efficiency and resource productivity within circular economy and waste prevention [1]. At their core, value retention processes preserve both material value and product functionality. Repair is considered one of the value retention processes. The United Nations International Resource Panel defines “value retention processes” as follows [1]:

“Value retention processes are activities, typically production-related activities, promoting the completion and/or potential extension of the useful product life beyond its traditionally expected use period. Such processes include direct reuse, repair, extensive refurbishment and remanufacturing.”

Within the DIN’s Environmental Protection Helpdesk (DIN EPH), working group 9 “Wear Parts” (AK9) deals with life cycle-oriented issues relating to products, processes, and organisations, with a particular focus on wear parts, i.e., those product system components that have a shorter service life compared to the potential total service life of the materials or the product system. One of the main focuses of DIN KU-AK9 [2] is the development of a technical specification (TS= guideline) DIN TS 35206 “Wear Parts”. Within the framework of the DIN standardisation process, the overarching “product system concept” is used as a starting point, which subsumes material, mechanical, electrical/electronic, digitised components, software, and information as system components. This range is also derived from the “goods concept” in the EU/2019/771 Goods Purchase Directive, which additionally includes digital content or digital services.

The term “wear part” is defined by DIN KU-AK9 as part of the overarching concept of maintaining the value or functionality of product systems as follows:

“Wear parts in the general sense are product system components, whose functional stability, due to their design, corresponds to a partial period of the potential material or product system service life.”

The term “partial period” may be illuminated for lubricants. Some automotive lubricants are designed to remain functional from one specified maintenance (drain) interval to the next, while others can be filled for life, such as transmission oils or lubricating greases.

The concepts for retention of value or functionality are in line with the United Nations Sustainable Development Goal #12 safeguarding sustainable consumption and production patterns.

Wear part

Currently, no binding definitions exist for the term “wear part”. Nonetheless, various terms circulate that are used and perceived similarly. Particularly, the term “spare part” is used with alike connotation. Worksheet No. 7 (2002) of the German Society for Tribology (www.GfT-ev.de) reveals the following definitions for “wear part” under entry #116: “Part stressed by wear. Predominantly used for parts subject to wear stress”.

Every equipment, machine or system is composed of individual components or assemblies (hereinafter referred to as “part”). Each part may fail or become obsolete for various reasons, making continued operation impossible. Ideally, every worn, defective or obsolete part is replaceable. Subsequently, every part is potentially also a spare part or ultimately a “replaceable part”. As a result, any kind of functional subsystem loss leads to a loss of usability of the entire product. Conversely, this means that all subsystems causing foreseeable functional loss, regardless of the mechanism causing it, must be replaceable. Function-maintaining spare parts needing to be replaced on a regular and intended basis are frequently summarised as wear parts, regardless of their failure mechanism. However, they are not faulty or defective. Instead, they are parts to be replaced as scheduled prior to the end of the product’s useful life, if the product was used as intended. Such parts are hence considered consumables as per EU/2024/825 directive for empowering consumers for the green transition and as such materials intended for “consumption in use”, e.g. wiper blades, tyres, brake pads and brake rotors/discs.

A wear part is therefore a replaceable component (or assembly) that can be substituted with a spare

part, that is functionally identical or has overlapping functionality, in order to maintain (in the sense of preventive maintenance) or restore the function and value of a worn-out, failure-prone, or defective product or component.

Functional losses resulting from pure wear mechanisms represent only a subset of possible wear-out pathways. Such wear-out failures are described in EN 45552:2020 as failures caused by cumulative degradation due to stress during normal use. Fatigue, material embrittlement, corrosion, degradation, oxidation, diffusion, and exposure to environmental/weather impact. are other potential mechanisms leading to failure (defects, part degeneration) or to the depletion of the intended function.

In terms of tribological functionality, also the lubricant¹ constitutes a potential wear part. In machine and system manufacturing, wear parts include spare parts intended to be replacing as precautionary measure to maintain functionality (preventive maintenance), e.g.:

- legally prescribed replacement intervals,
- elements to be replaced periodically for safety reasons (e.g. suspension cables, chains, bearings),
- parts composed of ageing or degrading materials (e.g. hydraulic hoses).

When elaborating on maintaining functionality, a spare part often offers improvement of machine or system as a retrofit, by modernisation or tuning instead of replacing the original part 1 by 1. Instead, a more sophisticated or, after many years of operation, more advanced state-of-the-art technology is incorporated. Due to their ease of replacement, lubricants are particularly well-suited for retrofitting

¹ The main purposes of lubricants are to reduce friction, minimize wear, and protect against adhesive failure (scuffing). Therefore, all aspects of resource and energy efficiency apply equally to lubricants. A lubricant is also a valuable source of information for observing the temporal changes over time on the wear parts it lubricates. Lubricants ensure wear protection and protection against adhesive failure (scuffing, seizure) through functional additives forming tribo-films, which in turn wear or wear out and can only be replenished from the lubricant in the tribo-contacts. At some point, additives for replenishing are no longer available resulting in a functional loss. Ultimately, the lubricant is consumed and thus “worn out” and seen as “wear part”.

intended to enhance energy efficiency by friction reduction. Obsolescence caused by outdated technology can be thus avoided.

A multitude of definitions are available for the term spare part:

i. DIN 24420-1

Spare parts are "parts (e.g. also called individual parts), groups (e.g. also called assemblies and part groups) or complete products intended to replace damaged, worn or lacking parts, groups or products."

ii. VDI 2892 (2019):

"Spare parts serve to maintain the function and retain the value of machines and systems in use. Provision of tailored spare parts is an essential influencing parameter for the availability and thus the economic efficiency of such machines and systems."

iii. Directive 2011/65/EU, article 3 (27)

Spare part — Spare part means a separate part of an electrical and electronic equipment (EEE), that can replace a part of an EEE. The EEE cannot function as intended without that part of the EEE. The functionality of EEE is restored or is upgraded when the part is replaced by a spare part.

iv. Automotive Parts Remanufacturers Association (APRA) [3]

Spare parts — Replaceable component, sub-assembly and assembly identical to and interchangeable with the item it is intended to replace. Note: Often called service part (in the US).

v. Basics of maintenance according to DIN 31051-2019

A spare part constitutes a part, component, device, subsystem, functional unit, operating equipment or system, which can be described and considered as intended to replace a corresponding object in order to maintain the originally required function of the object.

Note: According to DIN 31051, a lubricant (operating equipment) can be described and

considered as a spare part. Lubricants are integral elements of maintenance plans and intended for replacement as such.

vi. Federation of the German Construction Industry e.V [4]

"Normal" spare parts are not subject to any particular wear and are usually replaced as part of repairs or ongoing maintenance.

In defence, the U.S. DoD uses different wordings and has wide range definitions, like repair part, any part, assembly, or component needed to repair or maintain an end item or a spare part is an item purchased for replacement, replenishment of stock or for use in the maintenance, overhaul, and repair of equipment. ISO 2710-2 (section 3.3.15) defines a spare part just as broadly as an individual component or assembly that is kept in stock.

The distinction between a wear part and a general spare part can be illustrated using a household appliance example. The housing/casing of a kitchen mixer that breaks when dropped is not normally considered a wear part, because it is not expected to deteriorate during normal use. However, it may still need to be replaced to restore the functionality of the product and is therefore considered a spare part.

Wear-out

In 1969, the OECD's *International Research Group on Wear of Engineering Materials* (OECD-IRG) pointed out, that the distinction possible in German between "Verschleiß = wear" and "Abnutzung = wear + corrosion" (i.e., combined stress) does not exist in English, but the Dictionary of Lubrication Engineering translated "Abnutzung" as "wear out" [5].

Within the context of "wear", DIN 31051:2019 introduces another term: wear reserve (see section 3.3.4, *ibid*) describes the reserve of possible functions implemented under specified conditions. Once the wear reserve has been depleted, the machine loses

the capability to provide guaranteed or specific performance properties and must be repaired in order to restore the predefined nominal condition. Wear-out (connotated in German as "Abnutzung") is defined in DIN 31051-2019 (section 3.3.1) as follows:

"Degradation of the wear reserve caused by chemical and/or physical processes".

Note 1: Such processes are caused by different stresses, e.g. by friction, corrosion, fatigue, ageing, cavitation, fracture, etc.

Note 2: Wear-out is unavoidable.

DIN 50320:1953-11 and TGL 0-50320, April 1963, described wear-out as follows:

"The term 'wear-out' should be used as a generic term for mechanical impact (wear), chemical or electrochemical impact (corrosion) as well as for thermal and other impacts" (see 2.i.).

Thus, the use of the word stem "wear-out" in connection with combined or complex stress is emphasised in GfT worksheet no. 7 (2002) under entry no. 2 "Abnutzung-Wear-Usure" as "undesirable reduction in the utility value of objects due to mechanical, chemical, thermal, and/or electrical energy effects (see also DIN 31051)".

"Depreciation for wear-out of fixed assets" is firmly anchored in business management, accounting and tax law. Wear-out parts and wear parts are eventually synonymous variants. This creates a certain conceptual coherence between tribology, engineering and business administration (accounting). Overall, this results in a tripartite division into the terms "spare part, wear part and wear out part".

Definition of 'wear part'

As part of an intensive consensus finding process, GfT suggests to condense the following definition by limitation to tribological stresses [6]:

"A wear part is a replaceable part, subassembly or assembly identical to and inter-changeable with

the object it is intended to replace, all with the purpose of restoring the loss of function caused by wear mechanisms impairing either product or part."

Note: Wear mechanisms according to GfT worksheet 7 (2002): adhesion, abrasion, surface fatigue, tribochemical reaction.

Definition of "wear-out part"

The term "wear-out" appears today as a new coinage, but it had been predefined in the past (see Chapter 2). Since an object no longer functional is widely considered and in daily language termed as "worn", the term 'wear part', terminologically restricted to tribological aspects, is commonly used in a much broader sense. A seal, for example, usually fails due to shrinkage, swelling, and post-crosslinking, but not due to "wear". Nevertheless, a seal showing leakage is generally considered worn.

The word stem "wear-out" covers functional/value losses due to complex or combined stresses and leads to the term "wear-out part," which distinguishes it from a wear part. The extension of the term "wear part" for mechanical components or for systematically designed product systems beyond immediate tribology results in the following definition for the term "wear-out part":

"A wear-out part is a replaceable part, component, device, subsystem, functional unit, operating medium or system identical to and interchangeable with the object it is intended to replace, for the purpose of restoring the value or function of a faulty or defective product or a part consumed as intended."

Note: In addition to tribological wear, also corrosion, degradation, oxidation, diffusion and fatigue. can be subsumed as failure mechanisms (defects) or reasons for a reduction in functionality or value.

Conclusion

Clarifying the distinction between wear, wear parts and wear-out parts is not merely a matter of terminology, but a prerequisite for consistent understanding across engineering, maintenance and regulatory contexts. As outlined, the current lack of uniform definitions can lead to ambiguity, particularly as considerations of sustainability, durability and circularity become more prominent.

Establishing clearer conceptual boundaries provides a more robust framework for product design, maintenance planning and replacement strategies. In doing so, it supports enhanced durability, more effective value retention processes and alignment with evolving regulatory initiatives, including requirements related to reparability and resource efficiency.

Looking forward, the differentiation between wear-related concepts will become increasingly relevant as industries seek to extend service life, reduce material consumption and minimise environmental impact. Within this context, tribology and lubrication assume a broader role, contributing not only to technical performance but also to the achievement of sustainability objectives.

A shared and technically precise understanding of these terms therefore forms a necessary foundation for improved product stewardship, more efficient maintenance practices and the continued transition towards a resource-conscious industrial framework.

Bibliography

- [1] J. D. Russell and N. Z. Nasr, Value-retained vs. impacts avoided: the differentiated contributions of remanufacturing, refurbishment, repair, and reuse within a circular economy, *Journal of Remanufacturing* (2023) 13:25–51, <https://doi.org/10.1007/s13243-022-00119-4>
- [2] <https://www.din.de/en/wdc-proj:din21:390902775>
- [3] Remanufacturing Terminology - Remanufacturing

Term Guideline, 06.03.2012, Automotive Parts Remanufacturers Association, APRA Europe AISBL, Brussels

- [4] Wear part catalogue, Federation of the German Construction Industry, March 2008, D-10785 Berlin, Germany, <https://archiv2007.bgl-online.info/downloads/68044/Verschleissteile-Katalog-Vorspann.pdf>
- [5] J. Gänsheimer, *Dictionary of Lubrication Engineering*, 1999, WILEY, ISBN 3-527-29863-0
- [6] Wear parts - The distinction between the terms 'spare part', 'wear part' and 'wear-out part' in the context of 'obsolescence', White paper of the German Society for Tribology e.V., December 2025, https://www.gft-ev.de/fileadmin/Statische_Seiten/Publikationen/02%20Positionspapiere/02%20GfT-Positionspapier_Verschleissteil/GfT-Positionpaper_The_Terms_Wear-Wear-Part-Obsolescence.pdf

About the Authors

Dr. Mathias Woydt is

managing partner of MATRILUB Materials, Tribology, Lubrication, with more than 39 years of experience in R&D and Product development with more than 390 reviewed publications and 52 priority patents filed. STLE

Fellow, recipient of eagle award from ASTM and board member of the German Society for Tribology. He can be reached at m.woydt@matrilub.de



Rolf Luther is former Head of Advanced Development at FUCHS Schmierstoffe GmbH and currently serves as President of the German Society for Tribology e.V.. A recognised specialist in tribology and lubrication technology, he has contributed extensively to research and industrial practice in wear protection.