

# CRAFTSMAN'S CRIBSHEET

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## A Primer on Wear in Our Shops

There are three main kinds of wear, and these each have some common modes of occurrence.

Wear in metal parts can be defined as, "The undesired gradual change in dimensions in service under frictional pressure." Another way of saying this is that wear is the undesirable deterioration of a component by the removal of material from its surface; it occurs by displacement and detachment of particles from the surface.

Wear is usually evaluated in terms of weight loss, degree of surface degradation or life to a specified degree of wear as measured by specified means, such as thinning of a section.

Wear is often mistakenly thought of as a singular process. It has been helpful to me to look at wear as occurring in two or more stages. In the first stage, the material deforms. In the second stage, removal of the deformed material or the further and accelerated removal of material from where it has been displaced occurs. This can be aggravated by chemical and corrosive attack as an addition to the loss of material caused by purely mechanical means.

One way to classify wear processes is by describing the materials interacting abrasive wear, metallic wear and erosive or corrosive wear.

### Abrasive Wear

- Results from the relative movement between metal and nonmetallics or abrasives
- Can include metal against nonmetallic or abrasive materials failure modes
- Can include sliding friction, both wet and dry
- Can include rolling friction, both wet and dry
- Can include impact of loose abrasive, both wet and dry

### Metallic Wear

- Occurs because of the relative movement between metals
- Strictly metal-on-metal failure modes
- Includes sliding friction, both lubricated and non-lubricated failure modes
- Includes rolling friction, both lubricated and non-lubricated failure modes



### Erosive or Corrosive Wear

- A relative movement between metal and liquids or vapors
- These failure modes involve the attack on metals by liquids or vapors
- Wet steam
- Combustion gases

Three other types of wear are fatigue wear, cavitation erosion and fretting wear. In these types of wear, the cause of the deterioration is due primarily to forces rather than material differences.

Fatigue wear arises from cyclic stresses creating the removal of particles. This is the type of wear we see most often in our machine shops.

Cavitation erosion results from the loss of material because of high impact pressure or temperatures when vapor bubbles in the flowing liquid collapse. The cyclic stress resulting from the repeated collapsing bubbles results in surface fatigue wear. In our shops, we tend to see this on pump impellers.

Fretting wear is a wear process between two surfaces in oscillatory relative motion of small amplitude. Tangential displacement of first lubricant and then material results from the small but repeated relative surface motion. Then, chemical reactions predominate in the formation of oxides from particles removed in the wear process.

Sources include, "Steel Castings Handbook 5th Edition" and the 1971 edition of "Making, Shaping and Treating of Steel."

All Craftsman's Crib sheets are available for viewing and download at [short.productionmachining.com/cribsheets](http://short.productionmachining.com/cribsheets).