Reclamation Welding Technology – Part 1: Wear Factors

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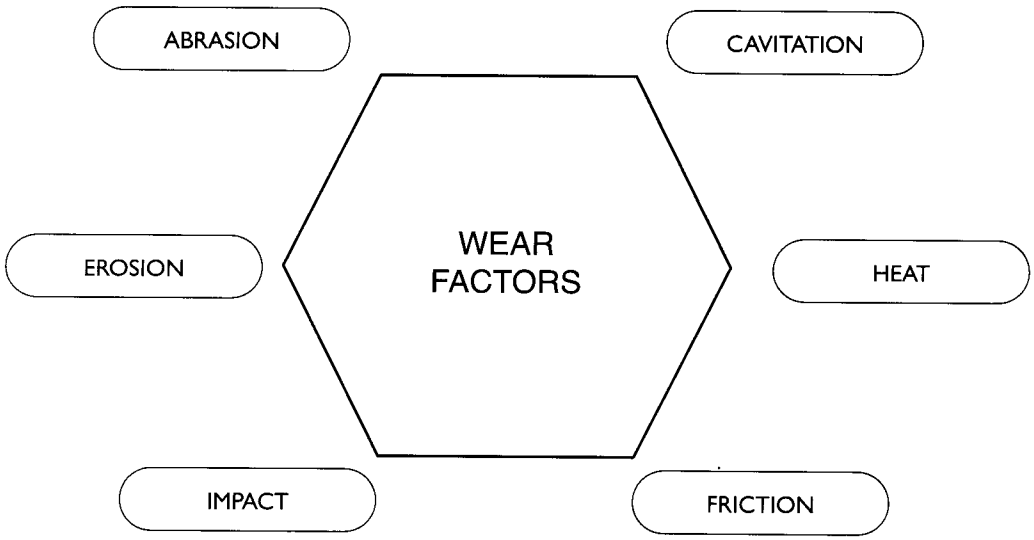
Generally, the method adopted for hard-facing worn parts like press screws in the palm oil industry does not give the expected life span as it fails to identify the wear factors. It can be compared to a doctor who first tries to understand a disease by diagnosis and then attempts to get rid of it by medication. Likewise, the palm oil mill engineer must understand the reasons for the wear before he can plan and take the necessary action to address the problem. The major wear mechanisms confronting the industry are listed below. These are usually called wear factors.



Abrasion Wear

It is generally defined as the rubbing of a foreign material against a surface causing it to wear. The factors influencing the rate of wear are: (a) the hardness of the abrasive material usually given as a number (Brinnel/Rockwell numbers) (b) the volume of the particles causing the abrasion (c) the size of the particles and (d) the profile of the particle, *etc.* The common types of abrasive wear are: (a) low stress abrasion (b) high stress abrasion and (c) gouging abrasion. The major machines commonly subjected to abrasion wear in the palm oil industry

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are press worm screws, press cages, digester arms and shaft, digester liners, wear plates and conveyor scrolls.

Frictional Wear

Friction is defined as the resistance to the sliding action between two surfaces in sliding contact. The wear could be less than 1 mm but the damage done can be severe, if not rectified in time. The factors influencing frictional wear are surface hardness and surface finish *e.g.* shaft, journal, sliding mechanisms, reciprocating engines/pumps *etc.*

Erosion Wear

Metal losses are caused by the impact of fine particles on a surface at high velocities either in an air or liquid medium *e.g.* fans, slurry pumps, impellers, hydro-cyclone cones, boilers and sterilizers. Typical problems faced by palm oil millers include (a) sand embedded in the fruit bunches propelled by the steam striking against the sterilizer surfaces and (b) particle laden flue gases in the boiler furnace causing severe erosion wear on all the surfaces it comes into contact during its passage through the boiler until exiting into the chimney. All these can be addressed if the technology available is adopted by them.

Corrosion Wear

This is defined as metal losses caused by chemicals or oxygen on metal surfaces. Corrosion is an electro-chemical reaction. When iron is in contact with water, which contains hydrogen ions, corrosion can take place. The hydrogen ions will become hydrogen atoms by taking an electron from the metal. The resultant metal ion will combine with the hydroxyl ions in contact with the metal surface and so form a metallic hydroxide, which is soluble in water causing metal corrosion. This action is similar to a battery action wherein the current is caused to flow from the anode to the cathode regions, the migrating ions in the water and the electrons in the metal forming the circuit. The most common examples are chemical tanks, pumps handling chemicals, boiler tubes, drums, sterilizer *etc.*

Cavitation Wear

Cavitation wear occurs when a liquid is subjected to rapid changes of pressures causing the formation of a gas or a vapour. Pitting (metal loss) is caused by the impaction of air bubbles on the surfaces they come into contact. Common examples are turbines, pump impellers, pipe bends when sudden change in direction of liquid occurs.

Heat Induced Wear

Components exposed to high temperatures and sudden cooling may develop cracks and embrittlement. Such cracks when further exposed to heat may lead to spalling of the metal, *e.g.* furnace doors and furnace parts.

Impact Wear

Force or weight, dropping or applying from a height is called impact. This type of wear occurs due to the plastic deformation of a metal caused by stressing. The factors influencing impact wear are surface hardness and toughness.

COMBINATION WEAR FACTOR

Sometimes we have wear that can take place by the combination of two or wear agents and they are classified as the combination wear factor. Typical examples are:

- impact and abrasion in the case of a ripple mill nut cracker;
- erosion and heat in the case of ID fans; and
- corrosion and heat as in the case of deaerators.

THE IMPACTS OF WEAR IN A PALM OIL MILL

It is generally observed that palm oil millers are slow to adapt new technologies that may initially appear to be costly but in the long run can bring down the mill maintenance cost dramatically. In most mills, the life span of a pair of screw is about 400 hr and the prices paid for

them vary from RM 1100 to RM 1500 depending on the locations and material. If some money is spent to hard face them say, and the life span of the screws is extended to 1200 hr, the mill will then enjoy a number of benefits. They are (a) money saved by extending the life of the screws (b) time saved for the press overhaul and (c) most important factor, which the millers overlook, is the significant impact on the quality of the palm oil. The amount of iron that the palm oil would otherwise have picked up, during the pressing operation, is reduced by one-third!

This is just one example. The same applies to the press cages, digester liners, fans blades, conveyor scrolls and elevator buckets, just to mention a few. The millers are urged to consider and implement the recommended actions and try to cut down maintenance cost and improve palm oil quality in one go. For more information, e-mail: spnara15@ hotmail.com ■