The 16 Losses In Total Productive Maintenance

To help identify all losses in a process system (man/machine/material), and thus, eliminate them, they have been divided into 16 categories, and can be grouped accordingly, as shown in Figure 1, with orange representing the equipment related losses, blue representing the losses relating to manpower and yellow representing the losses relating to resource consumption.

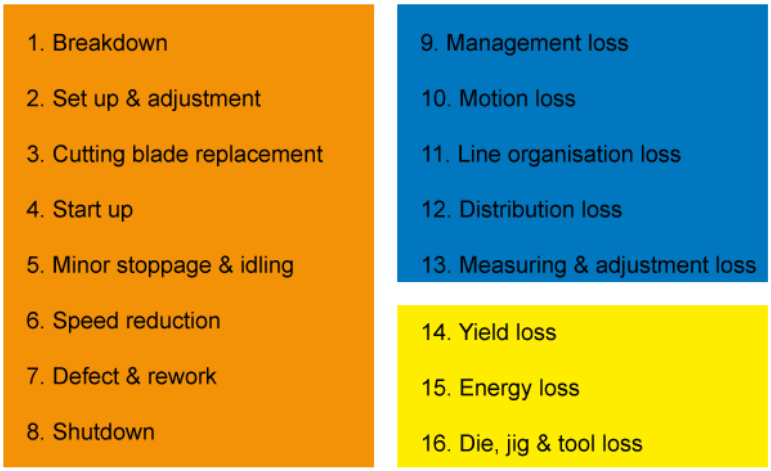

Figure 1: The 16 big losses

Equipment Losses

1. Breakdown loss: (unit time e.g. hours)
   The equipment breaks down causing the function of the line or process to stop. Often this is considered as a sporadic failure, typically caused by equipment component failure.

   Examples: Bearing failure due to wear, electrical fault, snapped belt.

2. Set up & adjustment loss: (unit time e.g. hours)
   This loss occurs during a changeover between products. Set up time is defined as the amount of time taken to change a process over from the last part of a production run to the first good, repeatable part of the next production run.

   Adjustment within the set up time is often hidden, and involves tweaking settings until optimal run conditions are achieved.

   Examples: Changing products, changing packaging, adjusting the feed rate.

3. Cutting blade replacement loss: (unit time e.g. hours)
   The time loss incurred swapping any consumable tooling item when it has become worn/ineffective or damaged.

Examples: Time spent replacing saw blades, cutting/grinding tools, and lathe tools.

4. Start-up loss: (unit time e.g. hours)
   The loss incurred whilst starting up equipment, to get to steady state operating conditions, after planned or unplanned shutdown.

   Examples: Time spent warming/cooling equipment to operating temperature, compressor/hydraulic power pack run-up time.

5. Minor stoppage & idling loss: (unit time e.g. hours)
   These are typically small stoppages not logged as breakdowns and issues causing the machine to pause or idle for short periods. They are often chronic losses, regularly repeated, often not recorded and usually less than 1 minute duration.

   Examples: Waiting for a machine to index, emptying a mould during press operation, a sensor fault or product blockage.

6. Speed reduction loss: (unit rate e.g. tonnes per hour)
   This loss occurs from operating at a speed less than the design speed.

   Examples: Line speed reduced due to quality issues or mechanical problems, gaps in the product on conveyors.

7. Defect & rework loss: (unit to match rate e.g. tonnes)
   This is the loss of defective product i.e. Not Right First Time which requires rework, repair or scrap.

   Examples: Out of spec product, low weight product requiring top-up, poor surface finish, incorrect labelling.

8. Shutdown loss: (unit time e.g. hours)
   The loss incurred by deliberately shutting down the equipment within the production plan.

   Examples: Routine maintenance, periodic overhaul, cleaning, statutory inspections.

Manpower Losses

9. Management Loss: (Unit = Time & £)
   These are waiting time losses generated by management problems.

   Examples: Failure to provide materials, spare parts, manpower resource, utilities, work instructions.

10. Motion Loss: (Unit = Time & £)

Losses are created due to unnecessary/excessive operator movement and transportation, as a result of poor layout and work organisation.

Examples: Walking loss, wasted motion e.g. unnecessary reaching and lifting

11. Line Organisation Loss: (Unit = Time & £)
    This loss results from a shortage of operators on the line and operators having to work on more equipment than was originally planned.

    Examples: No additional cover or contingency for break times, training and time spent off the line

12. Distribution Loss: (Unit = Time & £)
    This loss is the wasted time that is experienced in the incorrect or inefficient delivery of raw materials, packaging or products to and from the factory or the production line.

    Example: Incorrect delivery of materials from supplier to store, late deliveries, excessive handling of deliveries (double handling)

13. Measurement and Adjustment Loss: (Unit = Time & £)
    This loss is caused by the frequent measurement and adjustment to prevent the recurrence of problems.

    Example: Excessive inspection integrated in the process as a result of poor quality and failure to find root cause. Adjustment loss is experienced when adjusting equipment back to the standard after routine cleaning and periodic consumable changes (e.g. labels, film, and ink).

Yield, Energy & Tooling Loss

14. Yield Losses: (Unit = £)
    This is the total loss between the input of raw material and the output of finished goods.

    Examples: over-pack, giveaway, mass balances

15. Energy: (Unit = £)
    Energy loss is the input energy which cannot be used effectively for processing

    Examples: Start-up losses, Idling losses.

16. Die, Tool and Jig Losses: (Unit =£)
    This is the cost of the physical consumption of the spare parts or the refurbishment/maintenance of items that are used on the line.

    Examples: Cost of spares, cost of replacement and maintenance to tooling, dies and jigs.