Machinery lay-up (or Mothballing)

A guide to loss prevention
The practice of mothballing plant and equipment for storage and future use is performed regularly. It is vital that mothballed assets are protected from corrosion to maintain their value. While most companies recognise the importance of routine maintenance for their industrial equipment, many risk permanent damage when they fail to take appropriate steps to mothball the equipment.

**A guide to loss prevention**

The risk is real: equipment that is not properly mothballed can quickly show signs of internal metal corrosion that will significantly reduce component life and cause startup problems when the equipment is brought back into service. Without proper protection, water can enter through breathers and other openings. Proper mothballing can help significantly reduce water contamination.

**Common terms**

**Short-term layup:** is also known as “seasonal layup.” Usually, this period extends for three months or less, so no equipment dismantling is involved. Little or no maintenance is performed and all components are left ready to run.

**Extended layup:** could be anywhere from 3 to 24 months and may have an undetermined timeframe. Typically, steps must be taken to prevent corrosion and air and moisture intrusion. Drainage may be necessary for fluids, temporary heaters or dehumidifiers could be required, and certain equipment may be isolated or disconnected.

**Mothballing:** is similar to extended layup, but the timeframe is indefinite - usually well over 12 months. It would require major work and expense to restore operations. The owner may elect to sell off pieces of equipment, or the entire plant.

**Moisture/water build-up** inside the machine that can break down into acids that cause internal corrosion

**Vibration** from external movement causing microwelding of contacting surfaces (better known as fretting corrosion)

**Foreign contaminants** that can cause abrasive wear on rolling elements.

**Corrosion**

Moisture is the biggest concern because it can affect the machined surfaces of metal components that are extremely susceptible to rust.

Moisture and corrosion can be managed by eliminating corrosive agents such as oxygen and certain chemical or biological substances; separating dissimilar metals; protecting surfaces with wet or dry films and eliminating and managing the source of moisture and humidity.

**Restarting the equipment**

Once an extended plant layup plan is completed and executed, it is critically important to monitor the condition of the plant and equipment and follow through on any scheduled maintenance or other work. A detailed plant layup plan will include specific steps for each piece of equipment or system to be preserved and placed back into service. During the restoration process after an extended layup, it’s important to reverse the actions that were taken to lay up the equipment and to make sure no foreign objects are left inside critical pieces of equipment. Also, line up systems properly prior to restarting the equipment.
Planning: Layup procedures not only must be effective, but also practical and convenient to implement. Complicated layup procedures are often ignored by plant personnel because they are too difficult to carry out. When executing an extended plant layup, a detailed plan should be prepared for each major piece of equipment or system. This plan might include: inspection, cleaning, isolation, occasional operation of components, required repairs or maintenance, corrosion protection and ongoing long-term storage requirements.

Whenever any equipment is removed from service for layup, it is recommended that the owner consult the original equipment manufacturer (OEM) for their unit’s specific layup requirements.

Key components of a layup plan include:

1 Duration: The anticipated length of a layup often defines the type and extent of procedures that need to be considered.

2 Time and cost: The time and cost required for a successful restart of certain components or systems must be weighed against its condition and remaining useful life.

3 Re-commissioning: The limited amount of time permitted by a company’s business needs and operations to return a plant to service will often preclude the use of some preferred layup procedures.

4 Plant design: The design of the plant can affect the selection of the layup method for certain systems.

5 Plant environment: In northern climates, freeze protection must be incorporated. Hot dry sites can be affected by sand and dust. Certain locations may need additional security to prevent theft or vandalism. Potential rodent infestation and damage to wiring and electronics should be considered.

6 Documentation: Since employees may leave a company over time, it is vital that the collected knowledge of the method of layup, the operation of the equipment and its condition be fully documented. To complete the mothballing process, the machine should be tagged with a prominent label (preferably red) stating, “This equipment has been mothballed. You must take necessary steps to prepare the system for restart.”

7 Regulatory requirements and environmental contamination: Various laws and regulations may apply to an extended layup of equipment or a facility. Inspect for contamination and make sure that any cleaning or decommissioning activities don’t create new hazards.

Case study

A major manufacturer ordered a 5,000kW electric motor as part of a plant expansion. However, with a downturn in the economy and cut backs in production the plant expansion was put on hold. Consequently, the motor was put into short-term storage which was then extended to long-term storage with the confidence of knowing the motor would be available when needed. But would it be?

To maintain the integrity of the motor while in storage it is recommended that the OEM instructions are followed. But as a minimum, plant operators should ensure that: proper storage be selected to maintain the OEM warranty; the equipment be kept in a clean and non-corrosive environment; the storage space ambient temperature remain above dew point to prevent condensation; the motor’s shaft be rotated at least every other month; the motor’s windings be checked periodically (megger tested); and regular visual inspections be performed for signs of corrosion or other damage or signs of vermin or other pests that may cause damage to the equipment.

In this case, these practices were not fully implemented and after a two-year layup, the motor was finally installed and failed during testing and commissioning due to a short circuit. This was caused by insulation damage by rodents. The ensuing costs for the repair of the motor amounted to well over £157,000 in addition to the lost revenues over the 90-day time period required to repair the damaged motor.

It can be costly when best practices in equipment lay-up or storage are ignored or circumvented. It takes thorough planning, vigilance and persistence to complete a successful extended plant layup. A conscientious inspection and maintenance schedule will help keep equipment in good condition during long-term storage and often can reveal potential problems before they become serious.

References

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Disclaimer: The guidance in this document refers to industry best practice loss control advice. Adoption of the advice contained within this document does not imply compliance with industry, statutory or HSBEI guidelines, nor does it guarantee that related losses will not occur. Original equipment manufacturer guidance should always be sought before mothballing machinery.
NOT IF, BUT HOW