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Recommendations for Protecting Industrial Equipment During Shutdown

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Rust is a specific type of corrosion that occurs on iron and steel surfaces when water and oxygen are both present. Free water or very thin, almost invisible films of water commonly found in humid atmospheres, can promote rust. Since air is the natural source of oxygen and moisture, and water itself contains dissolved air, the ingredients required for the rusting of iron and steel are nearly always present.

Unlike the corrosion of some metals such as copper and aluminium for example which results in the formation of a tight oxide film that protects the surface from further corrosion, the mechanism is different for iron and steel. Rust is porous allowing water and oxygen to penetrate deeper into the underlying surface of the metal, causing further damage to the machine parts.

Short Term Shutdown

If equipment is not going to be used as normal for a limited period of time, then the simplest form of protection is to operate the equipment periodically, say three or four times a month. Sufficient time should be given to ensure that the unprotected steel surfaces internally are re-lubricated effectively and that the film of corrosion protective additives are re-established to act as a further barrier to air and moisture.

If practical, with the circulating lubrication system in constant operation, run equipment regularly under no load.
This allows the oil to circulate and re-coat the metal surfaces with anti-corrosion additives contained in most good quality lubricants. For hydraulic systems with cylinders, operate each function through several cycles so that oil is re-circulated around the system.

For rotating machinery, it may be possible to operate the oil circulation pumps separately and then rotate the equipment. This will reduce the possibility of false brinelling which can occur to equipment that stays at rest in one place, under static load, and the area is subject to vibration from, for example, nearby operating equipment or passing vehicle or rail traffic. If vibration is likely, then it may be beneficial to periodically turn the shafts 1¼ turn manually to reduce the possibility of false brinelling.

The use of desiccant breathers on equipment and oil reservoirs is strongly recommended to reduce moisture ingress from the atmosphere entering the system especially when temperatures fluctuate causing the system to breath even more. These should be checked on a regular and changed as necessary.

If a system is left to stand for a period of time, free water - normally held within the system itself - will have an opportunity to separate from the oil. Unless a polyglygol based lubricant is in use, then the water - having a higher density than oil - will settle at the bottom of the system. This offers the opportunity to open the lowest drain valve point and any dead oil areas and remove any free water. It is also good practice to wipe all accessible surfaces clean of dirt and additional moisture.

Anywhere there is an oil-water interface, in moderately warm conditions, there is the possibility of bacteriological growth which could lead to filter blocking and bad smells. Eliminating the water as much as possible will help reduce the potential for a bacterial infestation.

Medium Term Shutdown

Consider whether any of the short term recommendations outlined above can be applied. If it is not possible to operate the systems periodically, then enhanced intervention may be considered. For small components, such as gearboxes and pumps for example, once they have been isolated and are not available for immediate start up, it may be possible to fill them completely with fresh oil thus eliminating any airspace above where corrosion may start more easily. If there is a likelihood of any free water, this must be drained off before the equipment is re-filled with oil. The components would need to be drained to normal level before they are re-commissioned and any isolation lifted.

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Any source of potential ingress such as seals, dipsticks, and access covers should be checked to prevent any contamination. All components that are not sealed should be inspected every month and any condensation drained from their bearing housings, sumps and oil reservoirs. If an excessive amount of condensation is found, investigate the source and take further action.

If a system operates with heaters, these should be used only when the oil is being circulated. This is to ensure that static oil is not exposed to high localised temperature.

Grease lubricated bearings should be purged with fresh grease to ensure that all cavities are completely filled. Take care with electric motor bearings that grease does not enter into the electrical windings of the motor. Before re-commissioning, remove purge plugs or grease nipples so any excess grease has an escape path. Operate the equipment until the normal operating temperature is achieved before replacing any plugs or grease nipples.
Excess grease will be purged from the openings so some clean-up may be required.

For engines, drain the existing oil completely and replace with fresh. Change oil filter(s). Then operate the engine under low load and slowly bring it up to normal operating temperature.
This circulates the oil through the various galleries in the block, piston cooling, etc. Isolate the engine so that it is impossible to start either remotely or locally. Seal air inlets and exhaust outlet so they are airtight, thus preventing any flow of air through the engine.

Documentation

Make sure that you record all your actions during this time. For example, attach a tag to each piece of equipment or make a record in your maintenance manual, documenting:

- The date the equipment was preserved
- Rust prevention procedure
- Steps needed prior to start-up

Start Up

At start-up, remove rust preventatives with a suitable solvent, drain excess oil and check the correct levels of oil. Ensure that any dead areas in the system are drained of water. After operating with the oil for several hours, take a representative sample and send to a specialist used oil analysis laboratory to confirm the condition of the oil, system and contaminants. During further operation, monitor the equipment for performance and leaks, especially seals, which may have been compromised if left static for an extended period of time.

These recommendations are made without liability to ExxonMobil. Customers should conduct their own analysis before making a decision. All actions should comply with the machine manual and be in conformity with applicable labor safety regulations.