CLINKERING

Clinkering is a term used, in a metalworking application, to describe the masses of oxidized cast iron chips often found within machine tools. They often appear to be brown, or reddish brown, and typically are hard, solid lumps that require considerable effort to remove from the interior surfaces of the inside of the machine tool.

HOW CLINKERS OCCUR

Clinkers occur when the cast iron chips and fines build up and remain undisturbed long enough for them to become oxidized together, forming a mass. Cast iron is very non-homogeneous and because it contains graphite flakes it can set up galvanic cells within itself. This results in very rapid corrosion.

If a cast iron work piece is machined with an aqueous metalworking fluid, the chips will be wet from metalworking fluid. The presence of water promotes even more aggressive corrosion due to galvanic action. The corrosion inhibition package of the metalworking fluid will retard this process, delaying the onset of the corrosion if the chips are constantly flooded or immersed in a metalworking fluid in good condition.

If the flushing action of the coolant stream is unable to remove the chips from the machine tool and carry them to a filtration system that can separate the chips from the coolant, they will begin to accumulate and the size of the mass will grow. This is typical of the chips that are flung and scattered by the cutting action to the corners and nooks of a machine tool. As this process continues, the chip mass fuses together and forms what is referred to as a “clinker”.

Cast iron is often machined dry, and this reduces the possibility of clinkering. If the environment allows a condensate to occur (such as a shop that is open to the outdoors, often occurring during the change of seasons when some desire a little “fresh air” into the shop and windows or doors are left open) the chips are wetted without rust protection and a clinker can begin in minutes.

WHY CLINKERS OCCUR

Clinkers occur because the conditions described above happen without intervention. Housekeeping routines for cast iron machining processes should be sufficient to prevent the masses from accumulating beyond the effective corrosion protection life of the cutting fluid.

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Soluble oil and semi-synthetic fluids provide a thin oily film on chips that help slow the clinkering process. Synthetic fluids will leave an imperceptible film, and rely solely on chemistry to provide rust protection. The high surface area of a chip mass does tax the corrosion protection chemistry, but glycerin based additives can supply additional film characteristics to extend the corrosion protection for cast iron chip masses.

The chip masses in the nooks and corners often do not get sufficient coolant flow to keep them exposed to adequate corrosion protection. As a consequence, the protective qualities eventually deplete and rust can occur, if the chips remain wet. The housekeeping routine should be frequent enough to remove the chip buildup before the rust occurs. Coolant flushing or better containment of the chip dispersal pattern can help reduce the need of physical housekeeping. More appropriately aimed flow, or increased volumes can control chip buildup. Better guarding can direct the chips into the chip removal system, and keep them away from nooks and corners.