

# Ecoresponsible lubricant application pays off

*Green application systems rewrite the story of nonfriction*

By Chuck Boelkins

The use of fluids and lubricants to reduce friction and to cool and protect machines and components during cutting and forming presents significant challenges for manufacturers. Environmental concerns have added new chapters to the situation. In the current social and political setting, a great deal of emphasis is placed on environmental stewardship.

As government regulation continues to increase, the cost of complying with environmental guidelines impacts overall manufacturing costs. In an already competitive manufacturing landscape, companies need to identify and bookmark ways to reduce excess costs wherever possible. It's no mystery that industrial lubrication just may be the low-hanging fruit for achieving considerable cost reduction, as well as to engage in environmental stewardship.

For most manufacturers, the purchase, handling, application, cleaning, maintenance, and disposal of fluids and lubricants can be 10 percent of total manufacturing costs, conservatively. Upon closer evaluation, many companies may conclude that they actually have nearly 20 percent of their operational costs bound up in these processes. In a business climate of thinning margins, it may make sense to perform due diligence on processes with this degree of importance. Yet the time spent on lubrication-related decisions, from the early product design phase to shop floor execution and management, is often cursory, at best.

How manufacturing operations handle and use fluids, from cover to cover—from their arrival at the facility through their use and disposal—ultimately comes to bear on the environment, and is increasingly intertwined with operating costs and profit.

It's clear that industrial lubrication types, practices, and disposal need to be compliant with environmental



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requirements. A few simple best practices can simplify processes and reduce lubricant consumption both outside and inside of the plant.

### *Fluid Reduction Principles*

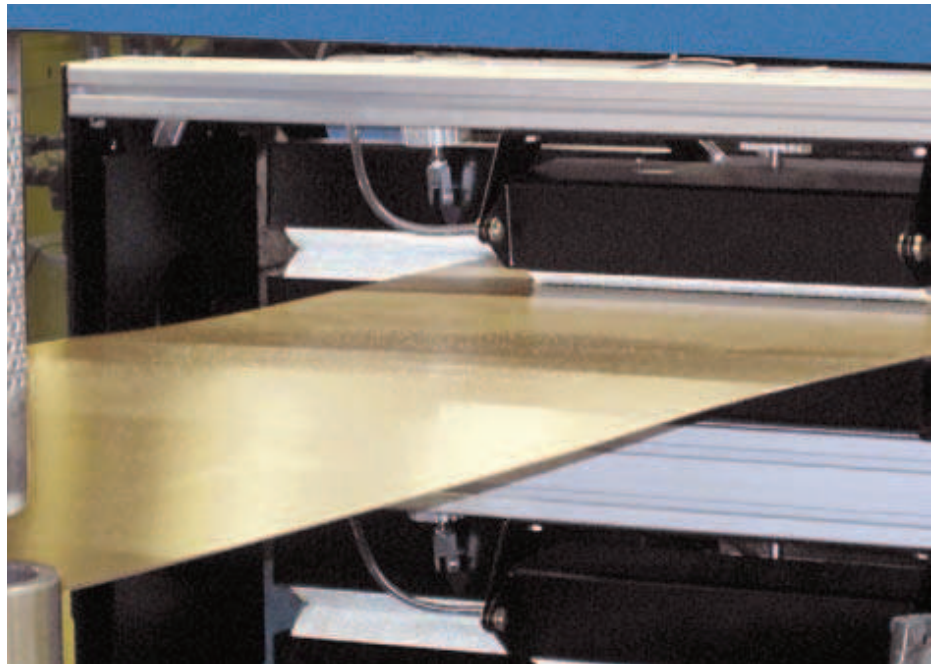
**Consolidation.** One of the basics of fluid reduction is fluid consolidation. Recent advancements in lubricant technology that yield formulas for every possible scenario are good, but sometimes lead to assumptions that a specific blend is required for specific material properties, feeds, tooling, or speed. Many companies with good motives have introduced too many fluids or lubricants into their processes.

The truth is that some new formulation advancements also enable fluids to have broader applications so that manufacturers can consolidate the fluids they use. Fluid consolidation has many benefits, including less treatment, if any; a smaller storage footprint; increased machine availability; and fewer disposal procedures. It is realistic for most manufacturers to be able to work with just one or two well-selected fluids.

Even with one or two lubricants, handling procedures in a facility should be evaluated frequently for efficiency. How a fluid is stored; whether it is mixed on-site or arrives ready for use; how it supplies the machine; and whether it is recycled, consumed, or disposed are all environmental considerations.

For example, mixing the fluid off-site increases shipping costs, fuel expenses, and so forth, but might be necessary because of water quality issues. If a lubricant is mixed on-site, it might be necessary to automate the mixing process to ensure consistency and adequate supply.

**Reduction and Control.** Fluid reduction and control are really two sides of the same coin. The single most important way to manage the environmental impact of fluids and lubricants in a manufacturing facility is to reduce the amounts that are consumed. The best



**Figure 1**

*Programmable roller lubrication spreads the lubricant evenly onto the coil stock, eliminating the waste of overlubrication in metal forming operations.*

way to reduce consumption is to use application methods that eliminate excess fluid by increasing control, efficiency, and precision.

**Total-loss Lubrication.** This lubrication objective refers to lubrication designed to be completely consumed in the process. Total-loss lubrication can be a key strategy in eliminating lubricant collection, recycling, and disposal. Many companies use this type of process to satisfy a zero-discharge policy.

### *Application Methods, Best Practices*

**Machining.** Minimum quantity lubrication (MQL) and near-dry machining eliminate excess lubricant. These processes consume only a small amount of quality lubricant—usually vegetable-based or synthetic—that is directed precisely to the *interface* between the cutting tool and the workpiece (see **lead image**). Unlike flood cooling, MQL lubricates only the necessary surfaces, usually through small external nozzles or with coolant-fed tooling.

Over the last 20 years, the practice

of MQL has experienced its greatest growth and development in Europe and Japan because of stricter environmental requirements there. Although machine tool builders serving U.S. markets previously were slow to recommend MQL or offer it as an option at equipment purchase, that has changed. Machine builders, MQL system manufacturers, and tooling designers have collaborated to equip companies with components that enable them to implement MQL in their operations.

While MQL or near-dry machining won't work for every application, when either can be used, the benefits of eliminating excess fluid are significant. Manufacturers that can use them may be surprised by their versatility and simple installation.

**Forming.** In metal forming, recently developed technologies increase application control and eliminate excess fluids. Press and press control manufacturers provide programmable control systems for fluid delivery as an add-on to coil handling equipment. Manufacturers of lubrication equipment can

provide them directly. These systems provide the ability to accurately control the amount of fluid applied and the frequency of delivery. This allows manufacturers to put fluids precisely where they are needed—and to keep them away from places and materials where they are likely to cause safety and contamination problems and to create the need for secondary operations.

The best way to reduce excess fluid in metal forming is with programmable direct stock lubrication (see **Figure 1**). Many forming applications will benefit from having an even coat of lubricant applied directly to the top, bottom, or both sides of the stock before entering the die. This can be accomplished easily in most cases using an electronically controlled roller lubrication system. When the lubricant, material, or other factors prevent the use of a roller system, spray nozzles with programmable control can be used instead.

In both scenarios the fluid control is the key to environmental success as well as a multitude of efficiencies in the plant. When fluid control is automated and managed, excess fluid formerly applied in unnecessary places no longer needs to be dealt with. Cleanup around the machine is minimized, and there is no need for sumps or other containment equipment. Many secondary operations can be eliminated. Spent fluids no longer need to be treated or recycled, and the disposal truck won't have to stop anymore for pickups.

In some cases, stock lubrication alone isn't sufficient for the metal forming operation, and supplementary lube must be applied directly to the die or tool. To facilitate this, the same controller that controls lubricant to the rollers can be used to spray metered amounts of fluid directly onto the tool or feed in-die into lubrication passages. Programmed frequency and duration of lube application at these points eliminates excess lubrication.

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As is true in all repetitive process lubrication for part manufacture, it is optimal to apply the correct amount to the part-machine interface, where the heat and friction are generated while the material is worked so that there is no need for lubricant to be applied anywhere else.

#### *Wear Point/ Maintenance Lubrication*

While machine wear point lubrication sometimes is considered a separate discipline from repetitive part manufacture, some principles apply to both and are still integral to an environmentally responsible machine lubrication program.


First, in terms of consolidation, economies can be found by evaluating lubricant types used in machine applications. While OEM recommendations should be given consideration, advancements in synthetic lubes and greases have enabled one or two types to be used throughout the plant in most cases.

In the past it was necessary to use mineral-based materials with little biodegradability. Now synthetics and vegetable-based lubes can be trusted to lubricate as well as most mineral-based lubricants and greases. These often are used in reduced amounts or with less frequency, conserving lubricant resources.

The traditional thinking in machine lubrication is that higher viscosity usually is more effective. Although viscosity is a necessary concern in some cases, lubricity is what really matters. In a needle bearing application, for example, high-viscosity grease appears to provide greater protection against wear. The truth is, grease can't travel

to all the places that a low-viscosity vegetable lubricant with more lubricity can, so in some applications, the low-viscosity actually works better. Using a low-viscosity vegetable fluid that travels better also prevents the accumulation of excess grease in areas where it is not necessary, which extra cleanup and contamination.

In wear point lubrication, there is also increasing opportunity for programmability. PLC systems provided by lubrication suppliers can now be integrated with existing machines, and they are often part of a new machine purchase. These systems enable the proper amount of lubricant to be applied at the correct time. This avoids two potential pitfalls: overlubrication—which can occur in manual processes in which the machine is lubricated in advance; and underlubrication—in which production schedules or human error keep the machine from being lubricated on time.

Although each company has its own variables to deal with, the basic approach for any company trying to make sound business and environmental decisions about lubrication begins with reduction, consolidation, and control. Many still consider these to be production and engineering concerns only. In modern business models, however, the lines between the technical and economic aspects of a company's operations are blurred. In today's current manufacturing climate, the two no longer can be viewed as unrelated. 

*Chuck Boelkins is president of Unist Inc., 4134 36th St. S.E., Grand Rapids, MI 49512-2903, 616-949-0853, cboelkins@unist.com, www.unist.com.*