The FABRICATOR®

Sawing? Cool it.

Coolants can extend blade life, improve cut finish, and quicken cut rates

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June 12, 2007

Nearly every metal sawing operation can become more cost-effective with a properly mixed and maintained sawing coolant. Proper use of sawing coolant improves cutting rates by balancing the combination of cooling and lubrication of the blade. Quality coolant improves the cut finish and can extend blade life by as much as 20 percent.

A quality, properly mixed and maintained sawing coolant helps increase cutting rates, improve the cut finish, and extend blade life.

Nearly every metal sawing operation can be made more efficient with a quality sawing coolant that is properly mixed and maintained. Coolants also improve cutting rates by balancing the combination of evaporative cooling and lubrication of the blade, thus improving the cut finish and extending blade life.

The sawing operation generates extreme heat when chips are sheared from the material and from the friction of metal-to-metal contact at high speeds. Using a coolant—flood-applied or misted—reduces the heat from these sources. Coolant also prevents metal chips from welding to the tooth face and altering the chip-removal capacity of the band gullets, dramatically affecting blade performance.

Machine Considerations

Some saws are equipped with a flood-applied coolant delivery system that captures and returns the coolant to a reservoir tank. Typically, a saw without a coolant delivery system should be used only for sawing easily machined materials such as mild steel and aluminum. On a vertical or horizontal saw, a misting system can be used to provide the lubricity needed to reduce frictional heat. A misting system does not provide evaporative cooling of the blade or the workpiece, however; therefore, band speeds should be reduced by 15 percent to

20 percent. Dry cutting requires a band speed half of the normally recommended speed when a coolant is used.

Material Considerations

In general, the slow cutting speeds and high feed pressures required for sawing hard or work-hardened metals also require a greater degree of extreme-pressure (EP) lubricity. On the other hand, easily cut free machining metals allowing fast band speeds and low feed pressures require a greater degree of evaporative cooling.

Sawing coolants absorb and dissipate heat through evaporation during the sawing process. Because heat builds up in the cut, a blade will get much hotter when it saws large cross sections of material than when it saws small cross sections. Free-flowing synthetic coolants can flow into the kerf more effectively than soluble oil, and so are more suitable for large cross sections.

Coolant Application Systems

Figure 1
For high-production operations, the most effective application method is a flood system with coolant flowing through the guide blocks to both infeed and outfeed sides of the material.

The most effective coolant application method for high-production sawing operations is a flood system with coolant flowing through the guide blocks to both infeed and outfeed sides of the material (see **Figure 1**). Application through the saw blade guides effectively reduces frictional heat and provides maximum chip lubricity as the band saw blade travels through the guides. This ensures that coolant is carried into the cut efficiently.

For small saws that are not equipped with a coolant collection table, a small, relatively inexpensive spray misting system may pay for itself over a short period of time (see **Figure 2**). Structural shape sawing often results in a high loss of coolant during flood system application. Fortunately, angle, channel, and tubing offer a small cross section to a blade, and so very little heat is trapped. Consequently, a misting system generally is effective in providing frictional heat-reducing lubricity to the blade.

Noteworthy is that both sides of the band saw must be lubricated. If one side is not, the blade normally will cut off on the lubricated side.

Selecting the Right Coolant Type

Soluble oil, with the lowest initial cost of the water-soluble coolants, must be examined closely to determine its true value. Soluble oil may contain any combination of fatty oils, sulfurized materials, chlorinated materials, and EP additives. Emulsifiers are added to allow these normally incompatible oil components to mix with water. This mix does not remain permanent and will separate to various degrees, especially when left idle for prolonged periods.

Figure 2
For small saws that are not equipped with a coolant collection table, a small, relatively inexpensive spray misting system is effective in providing frictional heat-reducing lubricity to the blade, especially for tubes and profiles.

You should remove regularly any oils that do separate to minimize the growth of odor-causing microorganisms, and clean soluble oil from the part before it is welded or painted.

Semisynthetic fluids are synthetic-based products that typically contain some oils for added lubricity and corrosion protection. They combine some of the advantages and the disadvantages of both soluble oil and a fully synthetic fluid.

As with soluble oils, semisynthetic fluids are prone to stratification, odor-causing microorganism growth, and short pump life. Because of the oil content, cut parts need to be cleaned before they are welded or painted, depending on the additive used.

Synthetic fluids do not stratify in the sump tank. Once they are mixed, they form true solutions, and the concentrate is no longer discernible in the mixture. Synthetic coolants are heavy-duty, oil-free concentrates. They normally contain EP additives and corrosion inhibitors. Synthetic concentrates are tolerant of water with high mineral content.

Unmixed synthetic products are nontoxic and environmentally friendly. As with any coolant type, once they become mixed with metal chips in the saw reservoir, they must be stored and disposed of as hazardous waste according to local regulations. However, because of the long useful life of synthetic coolants, it is likely that disposal costs will be reduced with their use.

A quality synthetic concentrate has a higher initial cost than soluble oil. It is formulated to provide better performance over the broad range of materials being cut today and reduce time-consuming problems up-line. Fabricators might find these to be more cost-effective in the long term.

Coolant Mix

Proper balance of lubricity and evaporative cooling is critical to achieve optimal coolant performance. You can achieve this balance by adhering to the initial and replenishment mix ratio instructions provided for the brand and type of coolant in use.

For example, if an initial mix ratio recommendation is 10-to-1, the manufacturer recommends 10 parts of water to one part coolant concentrate for optimal effectiveness. You should never pour straight concentrate directly into the saw reservoir; instead, mix it in a clean container with water and then pour it into the clean reservoir.

As water in the saw reservoir evaporates through heat dissipation, the reservoir will need to be replenished. The replenishment mix requires a leaner ratio than the initial mix because concentrate does not evaporate as quickly as water. For the coolant to maintain maximum effectiveness, measure the concentration using a Brix refractometer.

The ideal location for sampling is the coolant nozzle. Compare the reading of the existing reservoir mix to prior readings of the initial coolant mix to determine the replenishment ratio. Never pour water or concentrate directly into the reservoir. Always mix at least three parts water to one part of concentrate and stir vigorously before pouring it into the reservoir.

Flood System Maintenance

Clean, fresh coolant; a clean reservoir; and clean feed lines from the reservoir will maximize the effectiveness of any coolant.

It is best to check the saw reservoir daily to ensure that the coolant is not below the pump level and that the mix ratio is correct. Metal chips or process oils from saw system leaks or wheel travel way lubricants will degrade the coolant. Repair hydraulic leaks, flush the entire system with a quality cleaner/water mix, and then fill the reservoir with properly mixed fresh coolant. Change the coolant on a regular schedule, minimally two times a year, depending on the volume of production cutting. Regular cleaning of chips from the reservoir is important; but cleaning metal fines—nearly microscopic chips—from the sawing operation is critical, because if they flow through the system, they will dull a saw blade prematurely and wear saw guides, wheels, and other metal parts.

Troubleshooting Saw Coolants

Coolants are so important that they cannot be overstressed; a high-quality sawing fluid is one of the most important factors for effective cutting and maximizing band life. The fluids generally are trouble-free, but if problems do occur, the following can help correct them.

Rusting of the Saw or Cut Parts. The ratio of water to concentrate may be too high. Check the mix ratio with a refractometer and adjust the mix ratio to that recommended by the manufacturer. Keep in mind that contaminants in the coolant, microscopic organisms, and metal fines or chips can degrade the rust inhibitors in the coolant. Clean the system and start with fresh, clean coolant.

Foaming of Sawing Fluid. A mix ratio overly high in concentrate may have a tendency to foam. Check the ratio with a refractometer and correct the mix as necessary. Metal fines in the reservoir can rob the fluid of

antifoam properties. Cleaning the system of chips and fines may help. Air entering through loose hose or fitting connections can cause foaming, as can a reservoir fluid level that is below the pump intake. Check all system connections and the reservoir fluid level.

Odors or Surface Scum. Surface scum and foul odor from the coolant reservoir are usually caused by contaminants such as oil leaks from the saw, which allow microorganisms to grow in coolants warmed during the sawing operation or warm weather. A weak concentration ratio level will contribute to the problem.

Check for and repair leaks. Clean the entire coolant system, and refill the reservoir with properly mixed fluid.

Sawing Performance Drops. Begin troubleshooting of this problem with a thorough mechanical check of the saw and blade type. If both of these are fine, check to make sure that the coolant mix ratio is correct. Also check the bottom of the reservoir for fine chips. Fines can circulate into the cutting area and prematurely dull the blade, causing rough or crooked cuts. To correct this problem, discard the old coolant, flush the system, and refill the reservoir.

Hot or Blue Chips. Check to see that the coolant mix ratio is not too lean. You can check this by examining the flow to see that enough coolant is going to the cut.

If problems still exist, they probably are not coolant-related; instead, they are more likely to be caused by using an incorrect band for the application or an incorrect band speed SFPM and feed rate combination.