

Trouble Shooting during Cutting and Grinding Fluid Applications

The engineering industry encounters various functional, maintenance or physiological problems, during cutting/grinding fluid applications. The following tables give symptom, causes and corrections for these problems.

A) Machining Operation Problems and Corrections

| SYMPTOM | CAUSE | CORRECTION |
|---|--|---|
| Low tool life caused by abrasive wear. Chip curl decreases without burning; smoke or steam begins or increases ; cratering or rapid flank or primary wear occurs. | Lack of lubrication at cutting edge of tool allows mechanical abrasion between tool and workpiece. | Select fluid with better lubricating qualities. Increase concentrations on water miscible fluids. Replace all old cutting oils or water miscibles. Increase volume and pressure, and direct into clearance angles. |
| Low tool life combined with excessive heat. Pounding in the cut; underside of chip is rough and torn; chip particles, burns or heat checks on workpiece; chips discolored; steam smoke, or fire; heavy BUE (built -up edge) or burns on tool. | Inadequate cooling at cutting edge of tool encourages tool seizure or build up. | Select fluid with higher cooling capacity. Change from oil to water miscible. Increase flow or pressure; keep tool flooded. Improve application in clearance and back of chip. |
| Low tool life due to welding, chipping and complete failure. Heavy BUE on tool with particles on part; chipped tool. | Lack of anti-weld properties promotes the development of a BUE type chip. The unstable BUE and fragments leaving it are relatively much harder than purest material. This promotes rapid wear through sliding contact; and chipping by pulling out some of the base material when it leaves. | Change to a chemically active fluid, preferably oil or one with increased EP (extreme pressure) or lubricating qualities. Replace EP oils if indicated, because of reduced chemical activity. |
| Low tool life due to chipping. | Intermittent or non-uniform cooling effects. | Increase flow or coverage; keep tool flooded continuously. Improve direction of application. Change to fluid having lower cooling properties. Remove fluid on carbide tool. |

| SYMPTOM | CAUSE | CORRECTION |
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| Tool seizure on drill, tap, reamer, Tool sticks, braks. | Excessive thermal expansion due to inadequate lubrication of rubbing surfaces. | Select fluid, preferably oil, with better EP and lubricating qualities. Improve volume, pressure, and direction of fluid application. Check for dilution of fluid. Increase concentration of water miscible fluids if necessary. |
| Surface finish poor-rough, smeared, torn, marred, discolored. | Lack of lubrication. Chip interference. | Select fluid with better lubricating qualities to reduce BUE. Check for dilution of fluid. Improve volume, pressure, and direction to move chips out of cut area. Improve filtration to remove particles. |
| Out of tolerance parts. | Non-uniform or inadequate cooling. | Keep tool and workpiece continuously flooded. Maintain fluid at constant temperature. Check or dilution of fluid. |
| B) Grinding Operation Problems and Corrections | | |
| Loss of form ; high ratio of wheel wear to metal removed. | Water miscibles. | Change wheel to higher density, smaller grit. Increase lubricity of coolant. |
| Loss of part size; frequent wheel dressing. | Oils. | Reduce viscosity. Improve volume, pressure, and direction. Reduce fluid temperature to ambient. Change to softer wheel. |
| Burning , warping, expansion, softening, or rehardening of hardened steels; build up of residual stresses; pressure of steam or smoke. | Lack of lubrication. | Change to EP chemical. Decrease wheel density; increase wheel speed or decrease work speed. Change to softer wheel and more EP fluid. Increase water content, pressure, or volume. Apply through wheel. Change to softer wheel or more cooling fluid. |
| | Water miscible. | |
| | Oils. | |
| | Lack of cooling. | |
| | Water miscibles. | |
| | Oils. | |

| SYMPTOM | CAUSE | CORRECTION |
|--|--|---|
| Power surface finish. | Inadequate lubrication or cooling. Water miscibles. Oils. | Change wheel to finer grit. Increase concentration, pressure, volume. Improve filtration. Change to fat or EP fluid. Increase volume, pressure. Improve filtration. |
| Wheel loading-slick, shiny, or glazed surface. | Water miscibles and oils. Wheel too hard or speed too high. Grains are dull without being torn from wheel. | Use softer, more open wheel. Dilute concentration. Improve filtration. |
| C) Maintenance Operation Problems and Corrections | | |
| Corrosion of Machines or work. Rust (3). | Exhausted or missing inhibitor. Continued makeup with water only. | Add inhibitor to water miscibles. Do not use chromates or dichromates. Check concentration. |
| Rust on parts. | Condensing water vapor when temperature drops below dew point, normally overnight. | Oil parts with rust preventive or preservative oil-not machine oil through which water will penetrate. |
| Rust, rapid. | Acidic vapors from nearby pickling tanks. Also sea air and fly ash. | Use rust preventives specially recommended to withstand these conditions. |
| Rust, fingerprints. | Inorganic salts in the sweat glands residues are insoluble in oil. | Must be removed by water or water-based rust preventive solutions immediately after handling. Then oil with preservative oil. |
| Stains, black sulfur | Iron combines with moisture and sulfur as a black, "smelly" sulfide. Often found where parts contact each other. | Wash off oil after machining or add sulfur inhibitor to cutting fluid. If severe, remove fluid with high moisture content and replace with fresh. If water miscible check for sulfate reducer bacteria. Replace with fresh coolant after proper cleaning of machine. |

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| Stains, general. | Chemical reaction between cutting fluid compounds and machine or workpiece. | Check moisture content in oils. Check EP compatibility with machine or workpiece. |
| Deposits on slides and ways; electrical shorts in motors. | Evaporation from water miscible fluids may leave hard, soft, or gummy deposits either in redissolvable or undissolvable forms. | Change to new fluid after cleaning machine. Change to de-ionized water. Eliminate fluid types with hygroscopic deposits to prevent motor short circuits. |
| Paint lift or peel. | Chemical action of additives in fluid, i.e. alkali, wetting agents etc. | Change fluid or paint. |
| Foaming | Presence of wetting agents , fluid made for harder water. | Add anti-foam agent; select new fluid. |
| Inverted emulsions. | Improper mixing of water into oil. agitation. | Mix oil into water with continuous agitation. |
| Slimy oil layer on top of water. | Gradual evaporation of water until situation becomes unstable and solution inverts; or tramp oil accumulation creates water shortage. | Check concentration on scheduled periodic basis. Drain, clean & replace with fresh mixture. |
| Insoluble soap curds. | Proper mixing but water is too hard. | Use de-ionized water. |
| Frequent machine cleaning Rapid rise of rancidity with bad odor, often over weekend. | Bacteria, Algae & Fungi may develop in machines using water miscibles; incorrect or incomplete machine cleaning procedures. | Proper maintenance procedures should include thorough machine cleaning with compatible germicidal cleaner after removal of old fluid. Consider changing type of fluid. |
| Plugged lines Reduced tool life. | Bacterial, fungi and algae growth can be extremely rapid in warm fluid, with resulting chemical breakdown and creation of sludge. | All deposits, particularly in corner and pockets should be removed mechanically, including cleaning of valves, lines, fittings, and pump. Circulate cleaner solution for sufficient time. Drain cleaner and sediment from sump. Circulate with clean water for sufficient time & drain. Refill machine with clean fluid |

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| | | <p>properly mixed in clean containers using clean, de-ionized water. Maintain good house keeping during use. Check mixture concentration regularly and makeup as required.</p> |
| <p>Fire or heavy smoke .</p> | <p>Low flash point cutting fluids.</p> | <p>Change cutting cutting fluids to heavy duty, EP type.</p> |
| <p>Fuming or boiling in reservoir or temperature.</p> | <p>Chemical reaction of chips or fines with cutting fluid. Common with nitrite solutions and aluminium.</p> | <p>Select new fluid. Improve filtration.</p> |
| <p>Weakening of grinding wheel bond.</p> | <p>Chemical action of cutting fluid.</p> | <p>Select new wheel or grinding fluid.</p> |
| <p>Chips and fines in fluid.</p> | <p>Inadequate filtration systems.</p> | <p>Check filters and strainers for proper functioning and establish periodic check. Severe cases may require additional facilities for centrifuging, or the use of settling tanks.</p> |
| <p>D) Physiological Problems and Corrections</p> | | |
| <p>Dermatitis-operator's skin dry and cracked, has rashes, pimples or burns or is irritated by general inflammation or sores.</p> | <p>Defatting of skin by solvents or low viscosity petroleum products.</p> <p>Excessively high alkalinity of some water miscible fluids.</p> <p>Breakdown into acids of some chlorine containing cutting oils either by moisture of skin or when some fluid get into water miscible mixtures, e.g. Brush on oils used on turret lathes where water miscible fluid is in the sump. Or, oil on parts from previous operation carried over into a water-mix fluid.</p> | <p>With low viscosity fluids, prevent skin contact by providing coverage of exposed areas (gloves, grauntlets, etc.) Be especially careful when operator or set up man goes from cutting oils to water miscible coolants (or vice-versa); in termixing of fluids on skin is usually irritating.</p> <p>When using straight oils, use water soluble barrier cream on hands and arms if necessary. When using water miscible fluids, use a water impervious barrier cream. Germicides in some creams can be irritants. All fluids become contaminated with use.</p> |

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| | | <p>Establish periodic cleaning of machines, sumps and lines, with germicidal cleaner, followed by satisfactory rinsing and replenish with fresh fluid. Do not permit refuse such as food, tobacco, or sputum to get into coolant.</p> <p>Personal cleanliness is the most important preventive to dermatitis. Instruct operators in proper cleaning of hands, arms, face, and use of clean clothing.</p> |
| NOTE : Dermatitis is usually not caused by bacteria But is usually chemical in origin. | | In the rare cases of operator allergic reaction, assignment to other tasks may be necessary. |
| Odour | Bacteria contaminated water miscible cutting fluids. | Establish and maintain regular schedule of preventive maintenance. Drain old fluid, clean machine, and replace with fresh fluid. |
| | Chemical compounds in fluids or chemical reaction between fluids and workpiece. | Exhaust air sufficient in volume. Change to new fluid. |
| Mist or fog | Air/liquid mist systems. | Increase air exhaust systems. Install automatic cutoff to prevent continuous spray during non-cutting periods. Change to flood application. |

Reference :

Cutting and Grinding Fluids : Selection and Application by R.K. Sprinborn, Editor
Published by American Society of Tool and Manufacturing Engineering.