Microlon.

MICRO-SPECIALTY LUBRICANTS 12 Main Street, Post Office Box 225 Akron, New York 14001

AMPCO TEST RESULTS

CONDUCTED BY:

Micro-Specialty Lubricants

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CONDUCTED FOR:

General Machining

DATE:

May 24th, 1982

PROBLEM:

Material - Ampco: gumming up, snapping off,
breaking and dulling of drills and taps

EQUIPMENT USED:

Bridgeport Drill Press

Bridgeport Milling Machine Assorted Drills and Taps

GOAL:

Prolong tool life*

The following were hand-treated**: 1/8", 1/4" and 5/8" stand high speed drills; 1/8", 1/4" and (3) 5/8" taps; (3) 5/8" used taps***

A 5/8" untreated drill was inserted into a Bridgeport drill press. Untreated water soluble flood coolant was hand applied. We squirted this on with a bottle. The operator drilled 12 holes before the drill began to overheat and the Ampco began sticking.

Microlon was mixed on a 10:1 ratio, as the flood coolant, with Recool (a coolant from Economics Laboratories). We replaced the drill with a treated 5/8" drill and drilled 47 holes in the Ampco. We stopped because we were running out of time; and the drill was still sharp. (It is our feeling that we could have gone on and drilled 100 holes.)

We tapped 14 holes with a new 5/8" tap; on the 15th hole, the operator ran the tap into the bottom of a hole and broke it. It was suggested that we try a previously rejected, treated tap. The rejected tap threaded 17 holes. A comment was made by the operator that he always had to use both hands when he removed the tap. He removed this tap by spinning it out with his fingers.

At approximately 3:15 p.m., we started working with a 1/8" drill.



Using the same 10:1 flood coolant, we drilled 6 holes (just like drilling through hot melted butter).

We tapped holes using a 1/8" tap. The operator commented that this was easier and cleaner.

- * The procedure used was not the preferred one of soaking drills and taps for 8 hours.
- ** Three wet treatments, each one followed with heat drying and burnishing.
- *** These taps were rejected by the operator on a previous job because they were not tapping anymore. They tap 12-14 holes, then they're considered not good enough, and are rejected.

NICKEL STEEL TEST RESULTS

DATE: May 27th, 1982

PROBLEM: Poor tool life, extended time for machining

EQUIPMENT USED: Carollton Drill Press

GOAL: Reduce amount of time to perform operation, ex-

tend tool life

Drilling a pilot hole in block stock with a 1-1/2" drill bit, the speed was increased from 350 to 500 RPM's . . . the feed rate was doubled. The drill was soaked for several hours, and a black oil solution was mixed: 14 ounces oil - 2 ounces Microlon. This was used for lubrication and TFE resin supply.

It was noted by the machinist, and his foreman, that the increased feeds and speeds doubled his piece rate. Twice as many were finished in the 6-hour period. The drill was in very good shape at the end of the night. It was noted by the machinist, that on the last hole, he did not use the oil/Microlon mixture, to see if any difference could be noticed. The difference was enough to burn and dull the tip off the drill, due to the increase in feed and speed, and the lack of Microlon.

INCREMENT TEST RESULTS

DATE:

May 26th, 1982

PROBLEM:

Poor tool life, difficulty machining, too

lengthy of an operation

EQUIPMENT USED:

Pratt-Whitney Triax

GOAL:

Prolong tool life, reduce time, improve product

quality

On May 26th, 1982, it was determined that the system contained 14 gallons of coolant. We installed 1-1/8 gallons of Microlon. The ratio of 11.2:1 was obtained and proved to be highly effective.

All the tools were soaked overnight, then oven-dried at a temperature of 150°F. In all cases, the RPM increased from 800 to 1000.

A 7/16" cobalt was more effective in drilling than the 7/16" high speed. Feed rate for the 7/16" went from .20 to .40, and feed depth per stroke went from 200 to 400.

Tentative piece rate had gone from 3 per 8-hour shift to 6 per 8-hour shift . . . a 200% increase in productivity.

On June 2nd, 1982, 5 gallons of coolant was added to the system. In keeping a consistent ratio, the addition of 56 ounces of Microlon was done. It was noted that, at 11:00 a.m., 13 pieces were completed with the same tools. These tools were soaked on May 27th, and used on May 28th at 8:00 a.m. The machinist noted a 400% increase in tool life (3 pieces prior to Microlon). The tools are still in use on this day, and noted to be in good condition.

On June 4th, 1982, 36 pieces were completed . . . the time to machine the pieces was cut in half. It was noted by the machinist, that the original tools lasted the duration of the 22-piece total that were machined under the previous noted conditions.

Some outstanding results were noted on the large increases in tool life . . . the 7/16" cobalt drill made 132 holes at the before-noted feeds and speeds as compared to 12 holes prior to the introduction of Microlon.

The 3/8" high speed drill was noted to be in very good shape, having made 132 holes, 1" in depth.

The 1/8" cobalt drill made 44 holes . . . noted to be in very good condition.

The tap used to make the thread in the holes was not soaked, but became impregnated through use. It was used, prior to the intro-

duction of Microlon for 28 holes . . . then, after the Microlon, it cut 44 more holes (it was noted to be about used up). There was an increase in tool life of approximately 300%.

Conclusions: The overall tool life was increased phenomenal amounts. The 7/16" cobalt drill went from a prior life expectancy of 12-14 holes. The Microlon-treated drill lasted for 132 holes . . . a percentage increase of 1000% in tool life.

The increases in tool life, coupled with increases in feeds and speeds, allow the operator to double his pieces-per-day output.

These benefits can only be obtained with the superior lubrication capabilities of Microlon.

INCONEL TEST RESULTS

DATE:

May 26th, 1982

PROBLEM:

Extended life for machining (approximately 36-40 hours), minimal tool life for very expensive tools compiled with high cost of regrinding tools, chipping and breaking of tools requiring downtime for changing and wasted time for restarting of sequence

EQUIPMENT USED:

Pratt-Whitney Wolverine

GOAL:

Reduce machining time, extend tool life to reduce tool changing downtime, and the reduction of costly regrinding

May 26th, 1982: On this day, we conducted an experiment involving the above mentioned metal. It was determined that the 100-gallon-capacity sump contained approximately 81 gallons of Recool (a product of Economics Laboratories). Since we had previously mixed the Microlon and Recool together, and it was determined by us to be compatible, we felt very confident about mixing the two on a large scale. We then introduced 7.25* gallons of Microlon into the coolant sump tank. The Microlon, which has a unique ability to emulsify in water, mixed in

quite readily. The outcome was a much whiter-in-color coolant, which is expected (when Microlon is mixed in pure water, it emulsifies to form a liquid that is white, like milk, and will not separate).

We then received a supply of cutting tools to be treated. These tools were soaked overnight, then dried at a temperature of 150°F**.

The proper tools were then installed, and the experiment began on a set of test pieces in the hardened state which were approximately half-way completed. Some benefits resulting from better lubrication were noticed, although the operator did not attempt to increase the feeds and speeds.

May 27th, 1982: After the initial pieces were completed, pieces in the solution anneal were mounted. The pieces in the annealed stage were explained to be slightly softer, but still very hard and tough. The prior time taken to machine these pieces was approximately 28-32 hours. The pieces were completed in 28 hours . . . the minimal increase in time saved, can be attributed to the use of programmed feeds and speeds.

The benefits of Microlon lubrication, noted for these pieces, were a great increase in tool life. In most cases, the tools lasted twice as long than on prior pieces. In some cases, the tool life was much greater than doubled.

The first set of annealed pieces was completed on June 1st, 1982.

On June 1st, 1982, a total of 20 gallons of coolant was added to the sump of the Wolverine. In keeping with the predetermined ratio, 1.75 gallons of Microlon was also added.

A second set of pieces, in the annealed stage, were mounted and begun. On this set, we began to increase the feed rates on the majority of the cutting sequences. The increases were in the range of 10% up to 15%, or 10% up to 20%, depending on the nature of the sequence. It was noted by the operator, that the trouble spots were instantly easier, and the feed rates were increased from 5% to 15%. It was then found, that on these same areas, the feeds could be up to 25%, and speeds run up to 125%.

The second set of annealed pieces were completed in 21 hours on June 3rd, 1982.

On Thursday, the 3rd of June, the first set of hardened pieces were mounted. The machining began at 11:00 a.m. on this date. The following step-by-step explanation of the sequences are what we observed.

June 3rd, 1982: Bottom cut and finish cut, with one set of carbide tip form cutters, in 45 minutes time. The cutters appear worn, although it should be noted that the feed was increased from 50% to 60% at an RPM of 100.

Side cut and finish cut, with one set of cutters making 4 passes, the cutters appear worn but not chipped or damaged. It was noted, the wear was not a maximum . . . in fact, the wear was very

minimal. The set made 2 passes, in the roughing stage, at a feed rate of 1.3" per minute, compared to a prior rate of .8-1.0"; the RPM was not increased. On the finish cut, the cutters made 2 passes at a feed rate of 1.3" compared to a prior rate of .8-1.0" and the RPM was not increased. It was noted, by the machinist, that the surface finish was superior to prior pieces. The approximate time for this sequence was 5 hours.

The 2-1/4" foot radius sequence was begun. The RPM was increased from 175 to 190; the feed was increased from 1" per minute to 1.3" per minute. It was noted, by the machinist, after 4 passes the tools were reuseable . . . without being sharpened. The finish time for this sequence was 1-1/2 hours.

Roughing with a standard, straight, 1" cutter was begun. The tools were mistakenly untreated, therefore, considerable tool wear was noted. However, on the first rough cut, the feed was set at specs 1.2" per minute. On the second cut, the feed was increased to 2.4" per minute. The RPM was not increased. It was noted that the RPM could have been increased, and the feed could have been increased, on the first cut. This sequence took 20 minutes.

Roughing inside radius of the test piece, the specs call for a feed of 1.25" per minute, and an RPM of 250. The type of tool being used, is a 1/2" ball-type mill cutter. The starting RPM was 300. The starting feed rate was 2.0" per minute. The first piece was finished in 20 minutes.

On the second piece, the feed and speed was maintained to before-mentioned settings. The second piece was finished in 25 minutes. The surface finish was noted to be very shiny and smooth. The machinist called the finish far superior. The total time was 50 minutes . . . the prior times were said to be somewhere around 2 hours.

The tools appeared to be barely worn. The machinist mounted them again, to be used for additional rough cut on the next set of pieces.

June 4th, 1982: 1/4" 4-flute ball nose, running at 450 RPM, up from 400. The feed rate was started at 2" per minute, compared to .75" per minute before Microlon. The sequence is the finish cut on the pieces: the feed was increased again to 2.5" per minute; the RPM was increased to 560 RPM. The cut was of very good quality. The sequence for the first piece was completed in 50 minutes. The finish was good quality. The tools appear to be in good enough shape to be used on second piece.

The second piece was begun at the same speeds and feed. The second test was finished in 55 minutes. The tools were somewhat worn, and should be sharpened. The surface finish was of good quality.

It should be noted, that at certain passes of the sequence, the feed was reduced to 2" per minute, due to thick amounts of material. The feed was then increased back to 2.5" per minute for

the duration of the sequence. It should be noted, that the same tools cut both pieces, which never happened before Microlon.

Finish outer half: tool used 3/16" ball nose, 7° angle plus sequence - speed is 560 RPM; feed is 2.5" per minute. The feed was decreased to 2.0" per minute on some passes, due to thick amounts of material.

The first set of hardened pieces was finished on June 4th, 1982 at 4:00 p.m. . . . 21 hours, total time.

At 5:00 p.m., the second set of hardened test pieces were mounted and begun. The feeds and speeds were kept at the before-explained settings, with some minor changes made by the operator. The main purpose of the continuing trial, was to attempt to duplicate the time and tool life extensions gained on the first set of hardened pieces machined with the use of Microlon.

The total time on the second set of hardened pieces was 21-1/2 hours, being completed on Monday, June 7th, 1982. On this day, an addition of 20 gallons of coolant was necessary. (The coolant loss is caused by the large surface area which it runs over.) After determining that, the cutting performance did not drop off. Because the coolant is 97.3% water, the great majority of the solution being lost is evaporation of the water. Thus, there was no reason to add more Microlon.

- * The resulting ratio of Microlon to Recool was 11.2:1.
- ** Some of the tools were hand-treated by spraying and heat-drying so that the experiment could get under way on the first day.

Conclusions: When the tests were begun, some basic guidelines were explained by the foreman. These guidelines were to extend tool life so that the tools would not chip, break, and wear out after one pass. The breaking of tools costs time to replace the tools, and time to restart the sequence. The cost to regrind chipped, or excessively worn, tools is very high, therefore, the savings connected with extending tool life is very important.

The increases in tool life, through the use of Microlon, were staggering. In all cases, the tool life was at least doubled. In some cases, the life was quadrupled. These gains can only be attributed to the superior lubrication qualities gained from Microlon dry-film lubrication.

With these gains in mind, it should be summarized that the amount of time required to machine these pieces, the time savings can be attributed to two factors. One - extended tool life; two - the ability to increase feeds and speeds, in most sequences, to rates that are double of the prior feeds used to machine Inconel. On some sequences, the feed rate increases were more than double of the prior rates. These rates are obtainable only with the superior lubrication found in Microlon. Up to this point, we have made note of benefits gained from Microlon use. These gains are a very simple concept when one can understand what Microlon does

to metal surfaces. A brief explanation follows:

The submicron-in-size TFE resins become impregnated into the surface pore structure of the cutting tools. This lends to the tool, a very smooth cutting edge and flute surface, by eliminating the peaks and valleys found on all metals. The perfectly smooth surfaces cut down on vibration, eliminating jagged cuts and galling. Aside from the reduced vibration, the ability to place a form of lubrication, on a tool that cannot be displaced by pressure, allows for the ability to increase feeds and speeds.