

6C- Metal Working Fluid Management

Preamble

The significance of Metal Working Fluids is widely recognized, but very often treated as support function that is Necessary but not Important. The average MWF cost in any industry will approximately range between 10%- 20% of the Total Production Cost. The TCO (Total Cost Ownership) of MWF has 2 components, viz. MWF Purchase and MWF Management. Of these, MWF Management is a significant contributor of TCO. Any lapse or gaps in Fluid management starting from right fluid selection, will result in a planned failure Today (“Parts” quality issues) and Tomorrow (deteriorate machine tool itself). To manage this significant contributor, it is necessary that we have a robust process.

Some predominantly common symptoms on a machine shop are, Smell, Skin irritation, Tool life, Corrosion, Residue, Paint peel off, foam etc. If you were to do a root cause analysis say, from among most probable causes like, “Concentration, pH, Water quality, Tramp oil, filtration”, etc... you will find high interaction among these variables making it quite difficult to pin point “THE ROOT CAUSE”. Hence many a times, a solution to a specific symptom or problem in one Organization or machine shop may not yield same result for the same problem in another organization. In these scenarios, one of the best proven, most economic methodology in problem solving is, to have good preventive measures through systematic approach to Periodic Fluid Management that will contain all the probable root causes within its operational limits.

6C- Concept

The Coolant Management Concept described here as 6C, is a fundamental, systematically choreographed Process, to effectively manage Metal Working Fluids, to hold the variables within its operational limits to increase Productivity and Performance in all forms of metal working application.

This article starts with the assumption that the **right coolant** has been selected for the application. Why this assumption.... that the coolant selection process is “application–manufacturer” dependent. As the process variables are relatively large and highly interactive, the same Coolant may not be necessarily suitable for same application across different industry segment or sometimes even within same industry at different location. Hence coolant selection must be done in conjunction with the manufacturer. However the 6C–MWF Management concept presented here is, generic and “application–manufacturer” independent.

All types of (expensive or economical) coolant have a life expectancy **designed** by its Chemistry as it is produced in the production floor. However the field coolant life expectancy is **determined** by the Biology (bacteria/fungi) of the coolant environment where it is used. Hence it is a fallacy that most coolant manufacturers claim their coolant life as x+ years as compared to their competition probably for getting around the sales not putting forward the fact that it is purely based on the design Chemistry, and ignoring the environment Biology of its ultimate use.

6C Coolant Management



The 6C, as a concept is presented here is to demonstrate how to institutionalize a coolant management system that will effectively increase coolant life to its designed life expectancy levels thereby reducing consumption, and improving performance of the machine tool in terms of tool life, component finish, machine down time, and finally reducing disposal costs.

With these in background, let us move into individual “C”.

1C.....Circulation

The method of mixing for Circulation forms an important beginning in the coolant management cycle. “Premixed coolant” addition is generally the best way to add new coolant into the machine. This ensures homogeneity in the fluid. Premix is done either through Automatic mixers or manually mixed by hand. Especially when handling emulsion products by hand, one must ensure to add coolant OIL (Oil In Last) into agitated water to set the Fluid Emulsion. This Fluid Emulsion has small oil droplets suspended in water phase that penetrate the point of cut better and reduce carry off of the fluid system. Note: Adding Water to the coolant oil will form reverse emulsion or Thick Emulsion and is not what we want to achieve!!!

In the shop floor reality, the coolant mixing is normally an outsourced activity and seldom the person involved is trained to do the pre-mix in the proper methodology. Thus the 1st C of the “6C” concept emphasis the importance of having good mixing and Circulation process which forms the foundation for realizing effective Coolant value. It is generally recommend going in for an automated mixer which could be a low end Venturi type or high end Proportional pump to overcome this issue. The payback normally for such mix system would work out around 6 months depending on the size and volume of usage.

2C.....Controls

This “C” is also the dashboard of the Coolant management system. This is the reason why most of coolant manufacturers or service providers who claim as providing coolant management service focus only on this segment of the 6C concept. The “Control” section is critical day-to-day activity which ensures the machine tool sump is monitored for Coolant level, Coolant Concentration, and Coolant pH. As water constitutes anywhere between 85% to 95% of end coolant, the Water quality parameter needs to be monitored on a minimum weekly or with an increased frequency depending on the water source being used.

This “C” is only the beginning of CMS, but for many this is also the end of CMS. It is up to the end user or the customer to impress with their CMS providers to look and travel beyond this “Control”“C” to complete the coolant management cycle.

3C.....Contaminant

The most common reason for many metal working fluid failure is contamination, or rather the unattended contamination. The two major contaminants are (floating) Tramp oil, and Metal chips & fines. In a machine tool, it is rather economical to have system to remove or reduce contaminant than prevent the contaminant itself. A wide variety of Tramp oil and Chips removal systems are available in the market, hence there is a need for proper understanding of the coolant dynamics in the machine and select appropriate on-line Tramp oil removal and Chips removal system. It is suggested that the end user in conjunction with the Coolant manufacturer should decide the best suitable methodology for on-line contaminant control and have the system installed. This is generally a one-time activity and then can be routinely maintained on by any CMS provider.

4C.....Cleanliness

The Cleanliness requirement of the sump is the most obvious and known factor but is the least attended to. The main reason being that, any sort of proper cleaning of a sump will need the machine to be down for a considerable time. The designers of the machine-tool more often overlook the necessity for a good assessable sump design for cleaning. In many cases the sump is a “design filler” and takes all sorts of geometry that cannot be assessed by human hand in a normal course. Also in reality, it is always when the machine is down; cleaning is undertaken giving no time for justifiable cleaning action.

To have effective cleaning, in constraint of available cleaning time, it is recommended to use sump cleaners that could completely empty the sump, clean particulate matter to say 50 micron (generally used filter size) and charge back again into the tank either manually or automatically. The automation system will be much more effective and the complete cycle for a 1000Liter sump cleaning will be anywhere between 20-30 minutes. Whereas the manual method would normally need over 4-5 hours. This way good cleanliness could well be achieved with good Return on Investment.

5C.....Cleaning schedule

It is just not good cleaning that is essential, but a sustained cleaning schedule that ensures cleanliness of the sump in an ongoing manner. This scheduling could be a part of Preventive maintenance (PM) or Conditional Monitoring (CM) schedules. The adherence to schedule should be driven from the top down else this will be just a cleaning activity. Thus “Cleanliness” is an Activity and “Cleaning Schedule” is a Commitment. This could be implemented through TPM.

6C.....Re-Cycling

Recycling is a well-planned and executed activity on a continual basis for (a) enhancing the performance of coolant by increasing its useful life, in turn (b) enhancing the machine cutting performance, and finally contributing to (c) greener initiatives by reducing disposal of coolants. All these of course giving better bottom line to shareholders.

We need to understand that Recycling does not transform Old coolant into New coolant, but merely reconditions the used coolant by removing solid particles, and Emulsified Tramp oil, through Recycling equipment and then with necessary addition of additives for Microbial control. Thus we need to understand that, the coolant that has deteriorated in its efficacy cannot be brought back to life through recycling. Another myth about recycling is, that coolant life becomes infinite by continuously recycling. This is not the case, the coolant has a design life expectancy and has to be disposed at the end of its life. The recycling will only ensure that you get the designed life expectancy of coolant. “Recycling” is not “Reclaiming” of coolants. This is the reason why a well-planned and scheduled management program is necessary for Recycling activity.

Conclusion

To conclude, most of the organizations execute 2nd C-“Controls” where a chart is displayed by the service provider in terms of 3 or 4 controllable factors and updated on daily basis. This is done religiously and rigorously without failure, as any slippage on this “C” will directly affect the production. The other Cs do not directly affect the Production, but affect the Productivity, and Performance, and finally the Profit. Hence a true coolant management must focus on all 6Cs.

It is necessary that any (new) business Concept or philosophy should be a set of simple principles/activities put together in a choreographed sequence of Processes to address Business 3Ps. (1)Business Productivity (2)Business Performance (3)Business Profitability. You will see that “6C” MWF management concept addresses all the 3Ps of the Business directly and indirectly. In Production terminology, Availability, Performance and Quality is considerably improved thereby improving OEE. 6C also ensures better wastage management by managing the unavoidable (Tramp oil, Chips & fines, sludge etc.) and avoiding the manageable (reducing/eliminating frequent disposal of coolant) for better environment.

In other words, 6C is one important component of any initiative like Lean / TPM /TQM contributing to increased business sustenance.