

BENEFITS OF VARIOUS KINDS OF COOLANTS IN CNC MACHINING 4 AXISES AND it is IMPROVEMENT

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ABSTRACT:

Machine coolants have been used in a way that covers or affects a large area in mechanical world in metal cutting operations from 200 years which is begun with consisted of simple oils served with brushed to lubricate the machine tools. Beginning with animal's fat – whale oil was added to decrease problems and to improve the oil lubricious.

As cutting operation become more updated machine coolant formulation become more complex and efficient.

In this paper we will determine and to improve the benefits of coolant lubrication systems with deferent kind of machining processes on working piece in 4- axis CNC milling and turning machines.

Key words >> The effect of coolant on metals during cutting operations.

INTRODUCTION:

In metals cutting operations on milling and turning machines 4 –axis CNC we are using high pressure coolant dispenser with spray jet cooling to enhances machining efficiency enhancing tool life and accuracy, and We will discuss the following topics as an inquiry's method.

Why using machine coolant?

Metal – removal techniques generate friction, which cause heating and excessive heat in metal removal is always a determinant then to provide proper size control and to get improper shape and accurate size with good finishing.

Machine coolants must be properly fulfill (2) important cutting functions

- Lubricant
- Coolant

Machine coolant should be including types which have to caring health and safety information's, and particle and bacteria removal.

Lubrication is very important because external friction, result of metal-to-metal contacts to improve cutting production and there is internal friction result of resistance of the metal atoms to movement when the metal is in shear zone which generate 2-3 of the heat, that's why cooling in cutting zone is properly lubricated, cutting and production mass will be effective and reducing friction without extent of metal size and lowering internal frictions.

How to reduce internal frictions?

Sulfur, chlorine, and phosphorus atoms with EP - extreme – pressure coolant additives penetrate the micro cracks in metallic surface preventing jumping of metal atoms displaced in the cutting process and reducing power needs to have and forming chip with lubricants in chip/tools surface interface, the angel of share plan increase a decrease it will be heat generate.

The coolant effect provides important to remove the heat from the tool, chip and all metal work piece, this cooling will be extents tool life by preventing tool from high temperature range during cutting processes and keep particles of the metals with wear rapidly and fail to meet tolerance for surface finishing and sizes, and coolant improve the quality of the production work piece.

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Machine coolant properties:

1. Corrosion protection:

There is some degree of corrosion protection must be in machine coolants, in machining operation freshly cut ferrous metal tend to rust rapidly since any protective coating removed.

With good machine coolant can avoid rust formation to protect damage in the parts of the machine and the work piece and inhibit protective film on cutting chips to prevent their corrosion and the formation of difficult – to – manage chunks or clinkers.

To avoid corrosion, a machine coolant must avoid metal moisture and oxygen from coming to gather so with chemical coolant contains through formation of invisible nonporous films.

With polar and passivation films, polar films consist of organic compounds (amines – fatty acids) which form a protective coating on a metals surface blocking chemical reactions, passivation films are formed by inorganic compounds containing oxygen (borates – phosphates and silicates) these compounds react with the metal surface , producing a coating that inhibit corrosion.

2. Stability and rancidity Control:

Animal's oil in the early days was used as machine coolant.

And because of bacteria and other microscopic organisms that grew and multiplied within the oil, modern machine coolant s is susceptible to same problem than most machine coolants now formulated with additives to control microorganism's growth and enhance machine coolant stability.

3. Transparency and viscosity:

It allows operators to see the work piece more clearly during machining operation in transparent machine coolants.

Lower viscosity machine coolants allow grid and dirt to settle out of suspension, and to improve the quality of the machine coolants recirculating through the machining by removal of these contaminants.

4. Health and safety considerations:

Should be the machine coolant non-flammable, non-toxic - none misting to minimize health and safety risks, almost machine coolants are not highly toxic and everything about machine coolants revised as first steps in machine coolant selections.

5. Flammability:

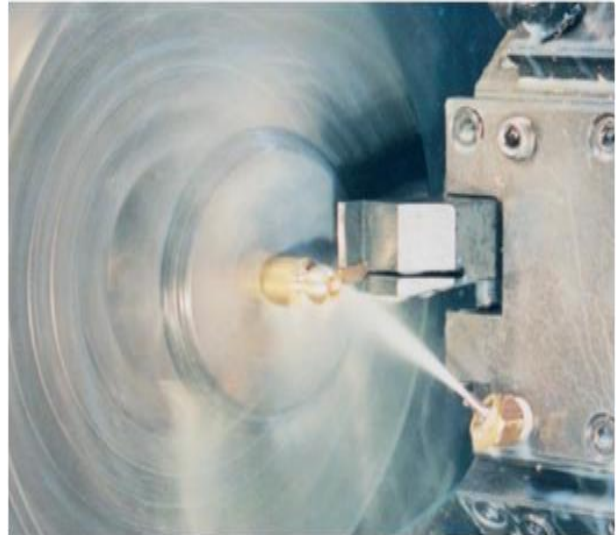
Machine coolants have high flashpoint to avoid problems associated with heat damage, smoke production or ignition.

6. Misting:

It is creating dirty work environments by coating equipment and surrounding work aria.

CNC 4- axes machining with spray jet coolant enhances machining efficiency enhancing tool life and accuracy of milling and turning study conducted shows pressurized nozzle coolant dispenser directed at the work piece leads to better dispensation, efficiency of the tooling system and better work piece finish.

Variable flow coolant technique controlled by variable frequency drive that controls center fugal coolant pump greatly enhance dispensation proportional to spindle RPM the pressurized coolant can enter cutting tool and the work piece enhance better bounding and reduce cutting time and wear.



HIGH VELOCITY COOLANT STREAM INCREASES PRODUCTIVITY AND TOOL LIFE IN MACHINING AND GRINDING OPERATIONS

Various coolant dispensing processes were studied.

AIR:

Cools and clears chips but has no purpose. Air coolant does not cool as efficiently as high pressure. For more sensitive materials, air coolant is often pressured over type that come in direct contact with the part. This is true with many hard plastics where thermal shock – rapid expansion and contraction of a part – can occur if direct coolant is applied. And not found to be suitable for high RPM CNC applications

MIST:

This type of low-pressure coolant is not sufficient, the evacuation of the chips. The heat is sufficient for an instance, where chip evacuation and heat are not major concerns.

Because the pressure applied is not great in this case where the mist is present. Whereas the parts and the tools of machine do not undergo additional stresses, so not it is suitable for high RPM CNC Applications.

FLOOD:

This Low-pressure method creates Lubricity, but the lubricity here is insufficient missing the required mark. Resulting also in very poor flushing out the metal chips.

The lubrication technique used here is used for better Coolant Dispensing, and it is called Minimum Quantity Lubricant (MQL). This Technique when applied with high Pressure Coolant Spray is more effective increasing the efficiency in dispensing of coolant fluid. Depending up on the need of the hour.

JET:

To reach the required heat sufficiency mark, jet cooling is used with high pressure spray jet coolant. Like flood coolant but delivered in greater than 1000 PSI. So, this is a great option for chip removal and evacuation, as it blasts chips away and cool the part simultaneously.



CNC coolant is all-too-often overlooked as a major component of a machining operation. The type of coolant or lubricant, and the pressure at which it is applied is vital to both machining success and optimum shop efficiency. For high speed 6000 RPM spindle high pressure coolant dispensing nozzles proved to be highly efficient and combined with variable dispensing pressure and volume

enhance the efficiency and economics in effective operation of the machine.

Deep -hole coolant-through combined with high pressure coolant dispensing seems to improve chip removal and heat reduction on drill tips.



Coolant Through Design for Improved Chip Removal

Pressure of coolant dispensed seems to greatly influence the efficiency of cutting 2000 MPA seems to be an ideal pressure to dispense the coolant anything greater than this seems to

overweigh the benefits of pressurized coolant as vary high pressure is counterproductive in damaging the work piece in microscope and expansive wear of tools.

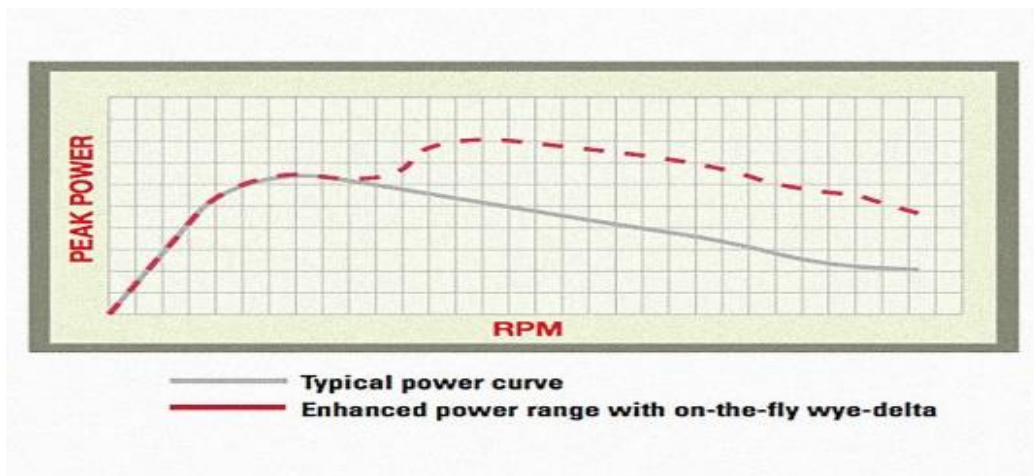
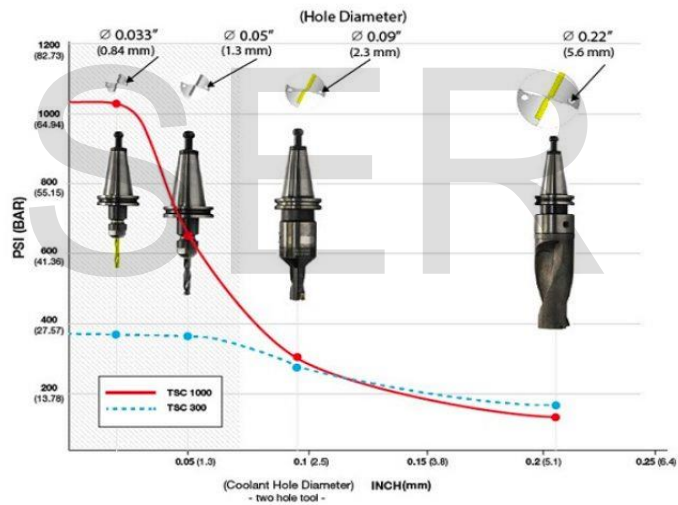
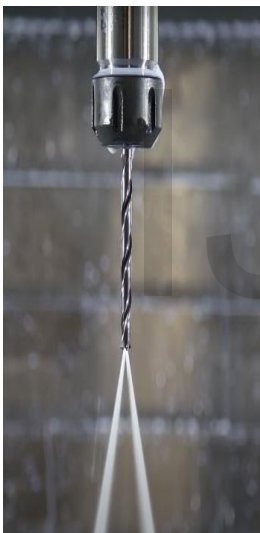
INTEGRATED COOLING TANK



IT was and experimented an integrated coolant tank with filtering re circulation and variable speed motor option greatly enhance the coolant efficiency of milling and turning

processes lead to saving of cooling fluid and over all saving to the cost operation of the unit.

COOLANT THROUGH THE SPINDLE DISPENSING @1000 PSI



It was observed the above method increases the performance of the machine rear to torque curve above and delivering coolant where it is needed.

It was observed dispensing high- pressure through-spindle is essential for deep-hole drilling and deep-pocketing operation. Keeping the tools lubricated and free of chips.

It was observed with the option, productivity can be increased by altering current program with faster federates.

And by optimizing drilling operations, leading to cycle-time reduction and higher quality parts.

Further adding the following features to 4-axis CNC machines will enhances the overall efficient dispensing of cooling liquid.

Automatic coolant refill system monitors the machine coolant level, and automatically ads correctly mixed coolant to the tank.

Coolant tank oil skimmer when installed automatically removes trams oil from the surface of the coolant life and reducing coolant maintenance.

Coolant mist condenser keeps machine is interior clear of mist and smoke generated by machining, improving visibility and allowing faster work piece.

VARIABLE FLOW COOLANT TECHNIQUE

When variable flow coolant pump is used by variable frequency drive to control the speed of coolant pump during operation which allows control of the speed of the coolant flow and pressure directly by software.

In general:

Reasons to use coolant Couse of three distinct reasons.

- Lubrication, aluminum, and some of steels are sticky with their chemical affinity for the cutter to weld and will try to weld themselves to the cutter, lubricating makes everything slippery and difficult to weld themselves.
- Chip cleaner, with spraying coolant fluid at the contact cutting area helps to move the chips out of the way of the cutter movements and away of feed rating for the cutter and minimized re cutting the chips – re cutting chips will be destroyed the surface of the finishing bass and with production line the cutter down in hole can

get clogged with chips and it will be hotter area and may be break.

- Cooling, existing liquid cooling more capable to carry heat from cutting area than the air – and with water base coolant is better than oil coolant base.

CONCLUSIONS:

- Machining is major part of all manufacturing organizations, efficient, economical, and ecologically friendly process effecting cooling of machining parts plays a vital role.
- This study represents various cooling techniques that can be employed for efficient cooling process, high pressure through nozzle dispensing of coolant with variable pressure option, through spindle, and drill dispensation of coolant greatly enhances the efficiency of the whole process.
- Recirculation and effective filtering process enhance the life of coolant and improves economics of operation.

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