

Here, we introduce the knowledge and various knowledge about the product TAKAMAZ a variety of machine tools. I hope you will help the daily work of customers

The 9th SEMI-DRY CUTTING INTRODUCTION CHAPTER 3



We have discussed semi-dry cutting (MQL) several times at TAKAMATSU RYU-GI.

In this article, we will focus on two semi-dry cutting methods:

- Cutting with oil mist spray
- Cutting with water oil mist spray

Cutting That Requires Cooling

Compared with usual cutting, semi-dry cutting uses only a very small quantity of coolant and due to this feature the shop environment can be kept clean and tool life can be extended because high-performance oil can be used. However, semi-dry cutting has a weak point as well. That is, semi-dry cutting with oil mist spray has no forced air-cooling effect. If cutting with large heat generation is continued only with mist spray, heat will build up in the workpiece, deteriorating accuracy and shortening tool life. Cutting that generates large amount of heat requires cooling.

What are the Cuttings that Heavily Generate Heat?

Heat is generated heavily during cuttings in which the contact area between a tool and a workpiece is large or the contact duration is long. Cutting materials with low thermal conductivity such as stainless steel also cause heat generation problems since heat is concentrated at the point of cutting. Among various cutting kinds, turning is one of the cuttings in which heat is likely to be generated since the tool nose is constantly located in a workpiece, although the degree of heat generation depends on the depth of cut and cutting time.

Types of Cutting

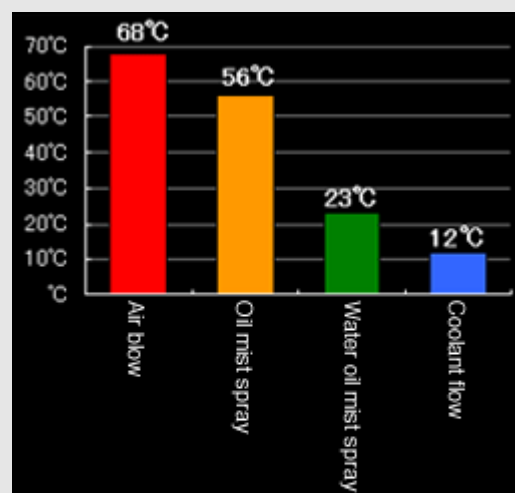
Although water mist has an effective cooling performance for the cutting explained above, it does not have lubricity or anti-corrosive properties and therefore a mixture of water and oil will be more appropriate. Here, we call the method that uses a mist of a water-oil mixture "cutting with water oil mist spray" in contrast to "cutting with oil mist spray" that uses only oil. Water oil mist cutting has two coolant spraying methods: spraying a water-soluble coolant and spraying water and oil individually using a dedicated nozzle.



Coolant mist equipment Sprays mist of water-soluble coolant

Cooling Performance of Water Oil Mist Spray

During cutting with water oil mist spray, unlike the conventional cooling method, large amounts of coolant do not circulate. In addition, since the sprayed water and oil evaporate, no waste is generated. What we'd like to know is its cooling performance. The graph below indicates the temperature of a workpiece after being subjected to rough turning process for 3 minutes with different cooling media: air blow (dry), oil mist spray, water oil mist spray, and coolant flow. As can be seen in the graph, cutting with water oil mist spray has a considerable cooling effect.



Temperature rise after 3-min rough turning on a lathe

S50C V=200m
f=0.4mm a=2.0mm
Continuous cutting time=3min.
Stock removal =160cc/min

Issues and Selection of Cutting Method

Although water oil mist spray has both good cooling effect and lubricity, it still has a problem. When compared with semi-dry cutting that uses only oil, it uses more than 10 times (100 to 200 cc per hour) the fluid (especially, water) and can make the workplace smoky. This must be taken into consideration when introducing this method to improve the workplace environment. When choosing between cutting with oil mist spray and water oil mist spray, we must study the advantages and problems carefully to select the cutting method that best meets our purposes. The key factor for selection is which is more important for your application, cooling effect by water or lubricity by oil. In continuous rough cutting on a lathe, water oil mist spray will be appropriate since heat tends to accumulate in the workpiece. Meanwhile, in finish cutting or near-net-shape cutting with small stock removal, oil mist is appropriate since it provides good surface finish and extends tool life.