



ABSTRACT

Name of the Institution: De La Salle University Dasmariñas Cavite

Location: Dasmariñas Cavite

Research Title: “Application of water and abrasives in cutting stainless steel”

Proponent: Alcantara, Reynaldo R.

Vargas, Eric A.

Source of fund: From the parents of the researchers

Cost: Php 3,500

Date Started: December 2001

Date Finished: March 2002

Objective:

A. General Objective

To introduce water and abrasives as an appropriate and suitable cutting medium in cutting stainless steel.

B. Specific Objective

- a. To introduce a process that will provide accuracy, flexibility and effectiveness in terms of cutting performance.
- b. To introduce a process that would be environment friendly using water and abrasives as the primary medium in cutting process.
- c. To provide a process that would be an alternative to other conventional cutting systems. (e.g. CNC).



Scope and Coverage:

This study focuses only on cutting process, which is covered by the machining processes. It includes factors, concepts, and ideas for the improvement of cutting process and mainly asked what is it? And how does it work? The study introduces a new technology to be used in manufacturing firms mainly in machining materials specifically stainless steels. It taps certain information about materials engineering and involves capability of a process to statistically obtain from advantages and disadvantages. The study will choose a certain machining process on a certain plant to obtain tangible information on cutting processes but doesn't need to form detailed information on that process. The study also constitutes theoretical information from other cutting processes and will acquire actual information from die cutting processes and other mechanical cutting processes.

It doesn't include various comparisons on other process to specify the study. It only helps to introduce a process that would be a benefit to the Manufacturing industry. Other cutting process that has been applied in material machining industries will only play as a part of this study to show the advantages of the new technology in cutting process, which the application of water and abrasives is, expected much to fall into.

Methodology:

The study constitutes introduction of cutting system from their capabilities, disadvantages, and quality to provide material designation for each cutting system.



The proponents also visited a manufacturing plant where there is a cutting process involve in the production of their products. The authors have interviewed engineers, supervisors, and workers from the machining section of Cavite Nagano Seiko, Inc. for whatever they can say about their cutting process. Conducting motion and time study provide us actual time for the speed of the cutting process they applied in their company and compare it to the speed of cutting process using water and abrasives. It also provides us information on how stainless steel was being cut using their existing cutting process procedures. The author's use manufacturing books related to cutting process and get information from the Web through Internet to obtain theoretical answers to research questions and to control variance. Analysis of the research information mostly composed the significance of this study. Relationship of other studies of other thesis authors was used to justify our study and to facilitate us in data exploration for the study conclusions.

Major Findings:

When water is used on steel work-parts, abrasive particles, such as garnet, must usually be added to the jet stream to facilitate cutting. Introduction of the abrasive particles into the stream complicates the process by adding to the number of parameters that must be controlled. Among the additional process parameters are abrasive types, grit size, and flow rate. Aluminum oxide, silicon oxide and garnet (a silicate material) are typical abrasive material used, at grit sizes ranging between 60 to 20. The abrasive particles are added to the water stream at approximately 0.5 lb./min (0.23 kg/min) after it has excited the nozzle. (Refer to figure 2).



Water and abrasive application to cutting process generates by using a water jet machine stream of water to between 36,000 and 60,000 pounds per square inch, powerful enough to cut through materials like metals.

This system injects abrasive, usually, garnet into the stream as it leaves the nozzle.

This combination can cut a wider variety of materials than plain water. The water jet head is often submerged in a water table to dissipate the noise.

Advantages:

Water jet and abrasive combination system are usually less costly than laser machines and create virtually no heat-affected zone. They are well suited for high performance steels.

Disadvantages:

Abrasive and water cutting technology has higher entry cost than plasma and oxyfuel machines and can be slower cutting.

Other cutting process like laser can handle material of limited thickness and may have difficulty cutting reflective material. Oxyfuel cutting is slower than other cutting process and leaves large heat-affected zones. Die cutting can be expensive because of die-making process. CNC machining often requires special tools and extensive programming. (Refer to figure 4)

3. Typical materials cut with water jet and abrasive systems include glass and ceramic, and sophisticated alloys where heating is undesirable. It can cut plastics, insulation, rubber, polystyrene, cement sheeting, titanium, brass, aluminum, stainless steels, stone, inconel, and composites.



Conclusion:

The authors concluded that the application of water jet and abrasives in cutting process makes a good quality cut edge to stainless steel but still other cutting process still be the best in other materials that the water jet and abrasive application cannot give a good cut. Plasma cutting can cut bigger materials that the water jet and abrasive cannot do. Oxyfuel cutting may be preferred choice than the water jet depending on the speed of cutting to other materials. But still, water jet has the finer and flexible use to cut various materials with high quality of cut edge and does not leave heat-affected zone that all cutting process cannot.

Recommendation:

The proponents of this research would like to recommend the application of water jet and abrasives in cutting stainless steel as the system to be used to cut materials with a high demand of quality. Steel Products with close tolerances and well-polished materials must undergo cutting process through the application of water jet and abrasive combination. Products that need an average tolerance and medium quality can be cut through the laser, oxyfuel, and plasma cutting systems. Big materials to be cut are preferably fit to plasma cutting because it cut material with big cut depth. Oxyfuel cutting is advisable to be used in high carbon steels to speed up operation.

The application of water and abrasives in cutting stainless steel must be applied when delicate tolerances are to be processed to ensure quality of product.



This system would be more applicable compared to other cutting process in terms of quality of product cut.

