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Machinist Dies After Being Struck By Object Thrown From Turning Lathe

MN FACE 97MN028

SUMMARY

A 42-year-old male lathe operator (the victim) died after being struck by a metal object that was thrown from a lathe. The victim was setting up the lathe for a production run of parts. He bolted an unfinished part to a holding device known as a fixture and mounted the fixture in the hydraulic jaws of the lathe's chuck. Although the required hydraulic jaw pressure for machining the production run was 300 pounds per square inch (psi), the manually controlled jaw pressure was not changed from the previous parts run for which it had been set at 170 psi. After installing the fixture in the jaws of the chuck, the victim closed an access door on the front of the lathe. He turned the lathe on and it began to machine the part by finishing a groove in its outer edge. During this portion of the process, the fixture and the part were spinning at approximately 500 revolutions per minute (rpm).

After the outer edge was finished, the computer controlled lathe automatically increased the speed of the chuck to approximately 1500 rpm. When the speed increased, the jaws of the chuck could not securely hold the fixture and the part because the jaw pressure was still set at 170 psi. The victim heard several banging sounds coming from the lathe and attempted to reach an emergency stop switch located on the lathe. The victim was struck in the head by the fixture and the part after they knocked the access door off the lathe and were thrown across the workshop. Other workers in the area rushed to aid the victim and placed a call to emergency medical personnel. Emergency personnel arrived shortly after being notified and transported the victim to a local hospital. Later he was transferred to a major medical center where he died two days later. MN FACE investigators concluded that to reduce the likelihood of similar occurrences, the following guidelines should be followed:

- **include operator prompts on the lathe control panel screen to ensure all system parameters are properly set;**
- **develop secondary couplers to retain items being machined if the lathe's jaws fail to secure items;**
- **develop a mandatory checklist for each set-up procedure to ensure that all steps are properly completed before machines are started;**
- **and place warning signs on machines to remind operators to properly set all manually controlled settings before starting machines.**

INTRODUCTION

On June 6, 1997 MN FACE investigators were notified of a work-related fatality that occurred on June 2, 1997. A site investigation was conducted by MN FACE investigators on July 25, 1997. During MN FACE investigations, incident information is obtained from a variety of

sources such as law enforcement agencies, county coroners and medical examiners, employers, coworkers, and family members.

The employer was a modern machine shop that produced precision machined components according to unique specifications for a variety of customers. The company began as a small home based business in 1968 in the community where the present manufacturing facility is located. The company employed 90-95 workers that included approximately 10-12 office personnel. The machine shop personnel consist primarily of machine operators, supply personnel, shipping and receiving personnel, and general maintenance personnel. The company employed a safety officer who dedicated approximately one third of their time to safety issues and procedures at the company. The company did not have specific written safety procedures for the task being performed by the victim. However, the victim had performed the same set-up procedures on several occasions in the past. In addition, during production runs in the recent past, the company had produced nearly 1000 parts identical to the part being machined at the time of the incident.

The victim had worked for the employer for approximately 13 years and was considered a qualified turning lathe set-up operator. He also had three years of similar experience with another employer before joining his current employer. He had graduated from a machinist program at a vocational technical school and had improved his job skills primarily as a result of on the job experience.

INVESTIGATION

On the day of the incident, the victim was setting up a computer numeric controlled (CNC) lathe for a production run of parts that were designed to a customer's specifications. A CNC lathe is a computer program controlled metal turning lathe (Figure 1) that produces finished metal parts or components using computerized controls during the machining process. The lathe had a three jaw chuck that used hydraulic pressure to hold metal stock while it was being machined. The hydraulic jaw pressure was manually set by the operator using an adjustable control knob and pressure gauge located on the front of the lathe. The stock was either held directly by the jaws of the chuck or the stock could be bolted to a metal fixture that was held by the jaws of the chuck. Fixtures were commonly used to hold large and/or irregular shaped items while they were being machined. In this case, a fixture was used to hold an aluminum sheave or disc that was approximately 17 inches in diameter and approximately 1.5 inches thick. The total weight of the fixture and the aluminum sheave was approximately 75 pounds.

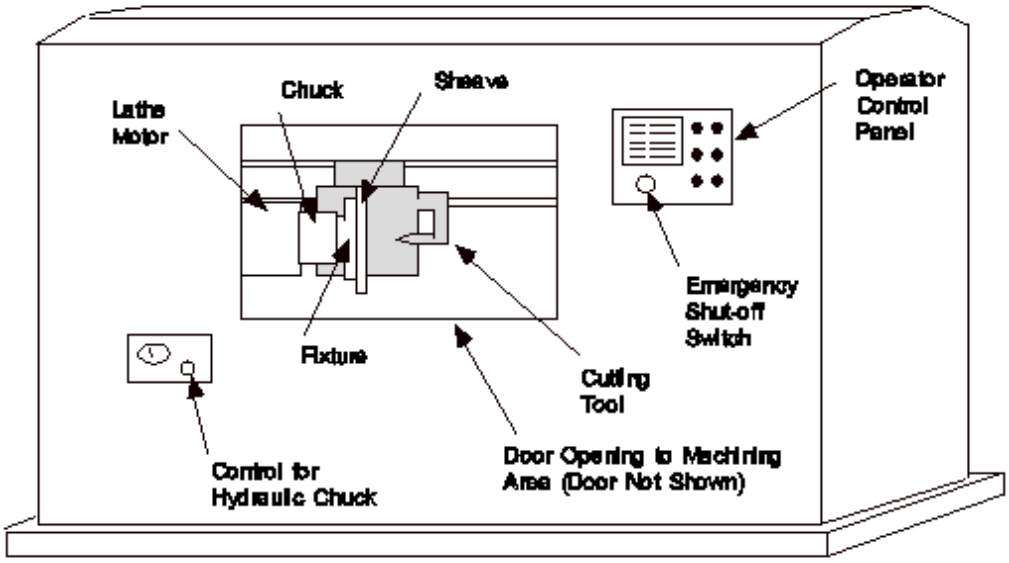

Figure 1. Computer Numeric Controlled (CNC) Lathe (Not to Scale)

The victim bolted an unfinished sheave to a fixture and mounted the fixture in the jaws of the lathe's chuck. The required jaw pressure for machining the aluminum sheaves was 300 pounds per square inch (psi). However, the jaw pressure was set at 170 psi for a parts run that had recently been completed on the lathe and was not increased to the required pressure of 300 psi. After installing the fixture in the jaws of the chuck, the victim closed a sliding door on the front of the lathe that enabled the operator to access the machining area inside the lathe. The victim turned the lathe on and the computer controlled lathe began to machine the sheave by finishing a groove in the outer edge of it. During this portion of the machining process, the fixture and aluminum stock were spinning at approximately 500 revolutions per minute (rpm). Although the jaw pressure was supposed to be set at 300 psi for the entire machining of the sheave, the lower pressure of 170 psi was adequate to hold the fixture and sheave in place while it turned at approximately 500 rpm.

After the outer edge of the sheave was finished, the computer controlled lathe positioned a cutting tool near the center of the spinning sheave to bore a hole in it. Before beginning the center bore, the computer program increased the speed of the chuck to nearly 1500 rpm. When the speed increased, the jaws of the chuck could not securely hold the fixture and sheave because the hydraulic pressure was still set at 170 psi. The victim heard several banging sounds coming from the lathe and attempted to reach an emergency stop switch located on the lathe control panel. The fixture and sheave were thrown from the jaws of the chuck and knocked the access door off the lathe. The victim was struck in the head by the fixture and sheave as it flew from the lathe and was thrown across the manufacturing area. Other workers rushed to aid the victim and immediately placed a call to emergency medical personnel. They arrived shortly after being notified and transported the victim to a local hospital. Later he was transferred to a major medical center where he died two days later.

Note: The lathe's computer program was not capable of changing the hydraulic jaw pressure from 170 psi to 300 psi during the machining of the part. This was a manual setting that was to be made before the lathe was turned on to machine the first item of each production run.

CAUSE OF DEATH

The cause of death listed on the death certificate was not available when this report was completed.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Include operator prompts on the lathe control panel screen to ensure all system parameters are properly set.

Discussion: Each production run of parts on the computer numeric controlled (CNC) lathe was preceded by a series of steps known as a set-up procedure. Proper completion of these steps by an operator was necessary to ensure that the correct computer program and other lathe parameters were entered into the system. During the set-up procedure, the operator received various prompts via the lathe's control panel screen that ensured the lathe was properly configured for the item being produced. However, the system was not programmed to prompt the operator to adjust the hydraulic jaw pressure during the set-up procedure. The lathe's program should be changed to prompt the operator to make all necessary settings during the set-up procedures and should provide a stop condition until each setting has been made or entered before continuing with the set-up procedure. If the system had included an operator prompt for the hydraulic jaw pressure setting and a stop condition until it had been correctly set, this fatality probably would have been prevented.

Recommendation #2: Develop secondary couplers to retain items being machined if the lathe's jaws fail to secure items.

Discussion: The computer numeric controlled (CNC) lathe did not have any redundant or backup safety devices to prevent items from being thrown from the lathe in the event that the jaws of the chuck failed to securely hold an item. It is recommended that multiple secondary mechanical links or couplers be designed that would prevent large items that are held by fixtures from being thrown from the lathe if the jaws of the chuck failed. These couplers should be designed to be connected directly to both the chuck and the fixture holding a large item and of adequate strength to keep the item and the fixture from being thrown from the lathe. Adequate redundant safety links would enable a lathe operator to stop the lathe if an item came free and would prevent items from being thrown from the lathe.

Recommendation #3: Develop a mandatory checklist for each set-up procedure to ensure that all steps are properly completed before machines are started.

Discussion: Each product or production run set-up procedure should have a mandatory operator checklist that must be completed before a machine such as the lathe in this incident is started. A mandatory operator checklist would insure that all system parameters and equipment settings are properly made before a machine is started. In this case, completion of a mandatory checklist that included proper setting of the hydraulic jaw pressure would have resulted in the pressure being set at 300 psi before the lathe was started. If the operator had been required to complete a mandatory set-up checklist before starting the lathe, this fatality probably would have been prevented.

Recommendation #4: Place a general warning sign on machines to remind operators to properly set all manually controlled settings before starting machines.

Discussion: The computer numeric controlled (CNC) lathe did not have a general warning sign to remind operators of the need to properly set all manually controlled settings before starting the lathe. The placement of a general warning sign near the equipment start/stop switch would serve as a final safety reminder to the operator before the machine is started. The development of a general safety warning sign for power equipment and the implementation of the above discussed recommendations would provide redundant safety measures for operators of equipment such as the (CNC) lathe in this incident. Implementation of this recommendation along with the above recommendations would reduce the likelihood of the future occurrence of similar type incidents.

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