Massachusetts Foundry Manager Dies When Caught in Die Casting Machine

Investigation: # 99-MA-070-01
Release Date: December 1, 2000

SUMMARY

On December 22, 1999, a 36-year-old male second shift foundry manager (the victim) was fatally injured while cleaning the die of a cold chamber die cast machine. The foundry's quality control inspector had notified the victim that one of the die cast machines was producing castings with a blemish on the exterior surface. The victim entered the machine operating area and leaned in-between the two sections of the die to clean them. The machine cycled to the closed position bringing the two sections of the die together while he was still in-between them. The city police and fire departments were notified immediately and arrived within minutes securing the scene of the incident. The medical examiner was notified and upon arrival at the incident site pronounced the victim dead. The MA FACE concluded that to prevent similar occurrences in the future, the employer should:

- **Enforce a comprehensive lockout/tag out program and constantly review and update the program and training.**
- **Ensure that new safety devices are installed properly and are effective before implementing them.**
- **Obtain information from the die cast machine manufacturer on the proper way to controlling hazardous energy when purchasing a used or remanufactured machine.**

INTRODUCTION

On December 28, 1999, the MA FACE Program was notified by a local health department through the 24-hour Occupational Fatality Hotline that on December 22, 1999, a 36-year-old male foundry worker had been fatally injured when he became caught in a die cast machine. An investigation was immediately initiated. The MA FACE Program Director and an investigator traveled to the job site where the vice-president of the foundry was interviewed. The police report, death certificate, corporate information, OSHA fatality/catastrophe report, employer interviews and photographs of the machine involved were obtained during the course of the investigation.

The employer, a foundry, had been in business approximately 97 years at the time of the incident. The foundry employed approximately 135 people in Massachusetts, 25 of whom were working the second shift at the time of the incident. The company had approximately 332 additional employees divided between two out of state locations and one location out of the country. The company's headquarters was located at the incident site, which the company had occupied for approximately thirty years. The vice president of the foundry was also in charge of employee safety at this location. The vice president attended a national manufacturer' organization's train-the-trainer class to obtain training videos and written information on the safe and proper use of die casting machines. The foundry had its own written safety procedures that were general and not machine or task specific. They also had a written hazardous energy control program with a lockout/tagout procedure that was not adequate or enforced. There was a safety committee at this site with rotating members including supervisors and laborers.

The victim had been employed by the foundry for approximately eighteen years at the time of his death. For the last eight years he was the second shift site manager. His training was primarily on-the-job with the company providing additional training through the videos and written information from the national manufacturer organization.

INVESTIGATION

The die casting machine involved in the incident was a 600-ton cold chamber machine. The machine was modified approximately four months before the incident to include an automatic casting extractor. An employee had installed the automatic extractor while an outside company programmed the control panel. Before the automatic extractor was installed, the operator manually extracted the casting by opening the operator's door causing the interlock system to engage. Installation of the automatic extractor required the operator's door to be kept permanently in the open position and the interlock system disconnected. With the operator's door permanently in the open position, a new guard system was needed to prohibit access to the machine operating area.

A fence type perimeter guard was installed as a replacement for the operator's door, which formerly functioned as a physical guard and part of the interlock system. The perimeter guard consisted of three sections: one gate and two fixed sections all approximately 48 inches high with the machine acting as the fourth side of the barrier. The disabled interlock system was incorporated into the perimeter guard gate, which was kept closed during the operation of the machine. When the gate was open the interlock system was automatically engaged and the machine would not resume operation without manually closing the gate and resetting the interlock system using the control panel. The control panel was located approximately four feet to the left of the perimeter guard gate and five feet high. The location made the control panel inaccessible to employees while inside the perimeter barrier.

The operation of the die casting machine began with an automated process of ladling molten metal from the crucible furnace into the cold chamber. The molten metal was then injected through a port into the closed and locked die by the forward motion of a hydraulic plunger. The

plunger sealed the port of the stationary section of the die to keep the molten metal inside the die at a high pressure. The beryllium and copper plunger tip contracted in size with the cooling of the molten metal. The cooling molten metal process was accelerated with a water-based cooling system. The plunger retracted when sufficiently cooled, releasing the die pressure and the die casting machine would cycle to the open position. The automatic extractor consisted of a long arm with a tong-like end that reached into the machine in-between the two dies and grasped a knob on the casting, pulling it out of the machine and placing the casting's hanger on the cooling rod. The machine would then close starting the cycle again.

On the night of the incident, the foundry's second shift crew consisted of approximately 25 employees, mostly laborers. There were approximately 10 machines operating, which included a number of die casting machines. The work area where the incident took place was approximately 30 feet long by 30 feet wide, very dimly lit and contained an uneven concrete walking surface. The area contained three die cast machines. At the time of the Massachusetts FACE investigation none of the three die cast machines were running, but the background noise within the work area was still loud enough to make verbal conversation difficult.

Prior to the incident, the quality control inspector had found a blemish on the exterior surface of the castings being produced by one of the machines and informed the victim of these imperfections. Although the incident was unwitnessed, evidence indicates that the hazardous energy control program including the lockout/tagout procedure had not been followed prior to the victim's entering the machine operating area. The die cast machine's main power shut off switch was not turned off and locked out. Also, the perimeter guard gate of the die casting machine was in the closed position, suggesting that the victim did not access the machine operating area through the gate. The area of the perimeter guard where the two fixed sections abutted were not fastened together. This would have made it easy for the victim to push apart the two fixed sections of the perimeter guard and enter the machine operating area with out opening the perimeter guard gate. If the machine operating area was entered by bypassing the gate, as mentioned above or by climbing over the perimeter guard this would allow the machine to continue to cycle while the victim was inside the machine operating area. Once inside the machine operating area, the victim apparently leaned inside the die space between the two separated sections of the die. He used a handheld abrasive-cleaning tool to remove excess aluminum from the dies. At some point, the die casting machine cycled to the closed position bringing the two sections of the die together while he was still leaning between the two dies.

Prior to the incident, the die machine operator was performing the usual task of operating a trim press, which was approximately eight feet from the die cast machine. The trim press was used to break away the excess aluminum from the casting including the knob that the automatic extractor used to grip the casting and the casting hanger. While operating the trim press the view of the die casting machine was obstructed. The operator only tended to the die casting machine when the machine's operation has stopped.

At the time of the Massachusetts FACE investigation the employer had welded the two fixed sections of the perimeter guard together eliminating the possibility of entering the machine

operating area between these two sections. During the investigation it was revealed that the company did not strictly enforce the lockout/tagout procedure when cleaning the dies during the normal operation of the machine. In addition the vice president of the company revealed that the die cast machine's plunger tip would occasionally stick and cause the die casting machine to stop. It was unknown if this occurred at the same time and contributed to the incident.

The city's police and fire departments were notified immediately. When police and fire personnel arrived they secured the scene of the incident. The medical examiner was notified and upon arrival pronounced the victim dead.

CAUSE OF DEATH

The medical examiner listed the cause of death as multiple trauma.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should enforce comprehensive hazardous energy control program including a lockout/tagout procedure and constantly review and update the program and training.

Discussion: OSHA regulation 1910.147 requires that employers establish procedures for isolating machine or equipment from the input of energy by affixing appropriate locks or tags to energy isolating devices. This is done to prevent any unexpected energization, start-up or release of stored energy that would injure workers during servicing and maintenance of machines and equipment. All forms of energy must be considered including electrical, hydraulic, pneumatic, and mechanical. Therefore, for each machine an individual lockout/tagout procedure is needed that specifies the requirements to properly perform lockout/tagout on that machine and when the lockout/tagout should be implemented, such as while cleaning the dies of a die cast machine.

A comprehensive hazardous energy control program is not going to work if the employer does not strictly enforcing the procedures outlined in the program. Enforcing a hazardous energy control program should include random inspections of employee work habits related to procedures outlined in the hazardous energy control program and continuous updates of the program and training. In this case, the employer had a hazardous energy control program in effect but it was rarely enforced.

Reviewing the comprehensive hazardous energy control program including the lockout/tagout procedure and the associated training should be performed at least once a year or when safety concerns arise. In addition, the hazardous energy control program should be updated when new equipment and new maintenance techniques are implemented. Involving the employees in the process of updating the hazardous energy control program and training is important. The employer should seek input from employees by having employees evaluate the effectiveness and limitations of the hazardous energy control program. In addition, the employer should ask employees about techniques involved in completing tasks that require them to expose any part of

their bodies to machine hazards, especially maintenance activities and common procedures that are not typically thought of as part of the everyday operation, such as cleaning the dies. Employees who spend the majority of their time operating and performing maintenance tasks on equipment will be good sources of information. These employees will know the most about the effectiveness and limitations of the hazardous energy control program. In this case, implementation the hazardous energy control program would have prevented the machine from cycling and bringing the two sections of the die together while the victim was leaning inside the machine.

Few maintenance procedures require the die cast machine to cycle in order to complete the task. The NADCA Machine Safety Requirements section 8.3 states "When motion of the die casting machine is required for maintenance, it shall occur in manual mode at a speed that is less than full machine speed. Any motion that creates a hazard within the operator's reach in manual mode shall be controlled with a two hand control device." Section 8.3 should be used only as a last resort safety precaution if the maintenance procedure cannot be completed without cycling of the die cast machine. The maintenance procedure should be performed with the machine in the lockout stage until the phase is reached when motion of the machine is needed. Then the NADCA Machine Safety Requirement section 8.3 should be implemented.

Recommendation #2: Employers should ensure that new safety devices are installed properly and effective before implemented them.

Discussion: Approximately, four months prior to the incident an automatic extractor and a perimeter guard which was connected to the already existing interlock were added to the die casting machine. To install the automatic extractor, the operator's door, which was originally connected to the interlock, had been placed permanently in the open position with the interlock disconnected. Before placing the machine back in service a thorough inspection may have identified that the perimeter barrier was not installed properly. The two abutting fixed sections of the perimeter guard were not secured together allowing access to the machine operating area while bypassing the gate and interlock system.

In addition, an inspection may have identified that the 48-inch height of the perimeter guard was not high enough to deter employees from climbing over the guard and bypassing the interlock system. A perimeter guard that is at least 8 feet high or a cage that enclosed the entire machine would be a better safety system. It would prohibit entry to the machine operating area when the interlock system was not engaged.

Recommendation #3: Employers should obtain information from the die cast machine manufacturer on the proper way to controlling hazardous energy when purchasing a used or remanufactured machine.

Discussion: When machines are purchased used or remanufactured, as in this case, the employer should contact the machine's manufacturer for suggestions on the appropriate hazardous energy control procedure including lockout/tagout for that particular machine. Also, before modifying a

machine with new equipment, such as an automatic extractor, the employer should contact the machine's manufacturer and the manufacturer of the new equipment to obtain their recommendations about the modification and any additional safety precaution that should be taken either in the operation of the machine or the controlling of hazardous energy.

REFERENCES

Code of Federal Regulations Labor, 29 Part 1910.147 The Control of Hazardous Energy (Lockout/Tagout).

Code of Federal Regulations Labor, 29 Part 1910.212 General Requirements for all Machines.

North American Die Casting Association Board of Governors, Safety Requirements for the Design, Manufacture, Maintenance and Operation of Die Casting Machines, 1999.

Figure 1 - The Die Casting Machine Perimeter Guarding

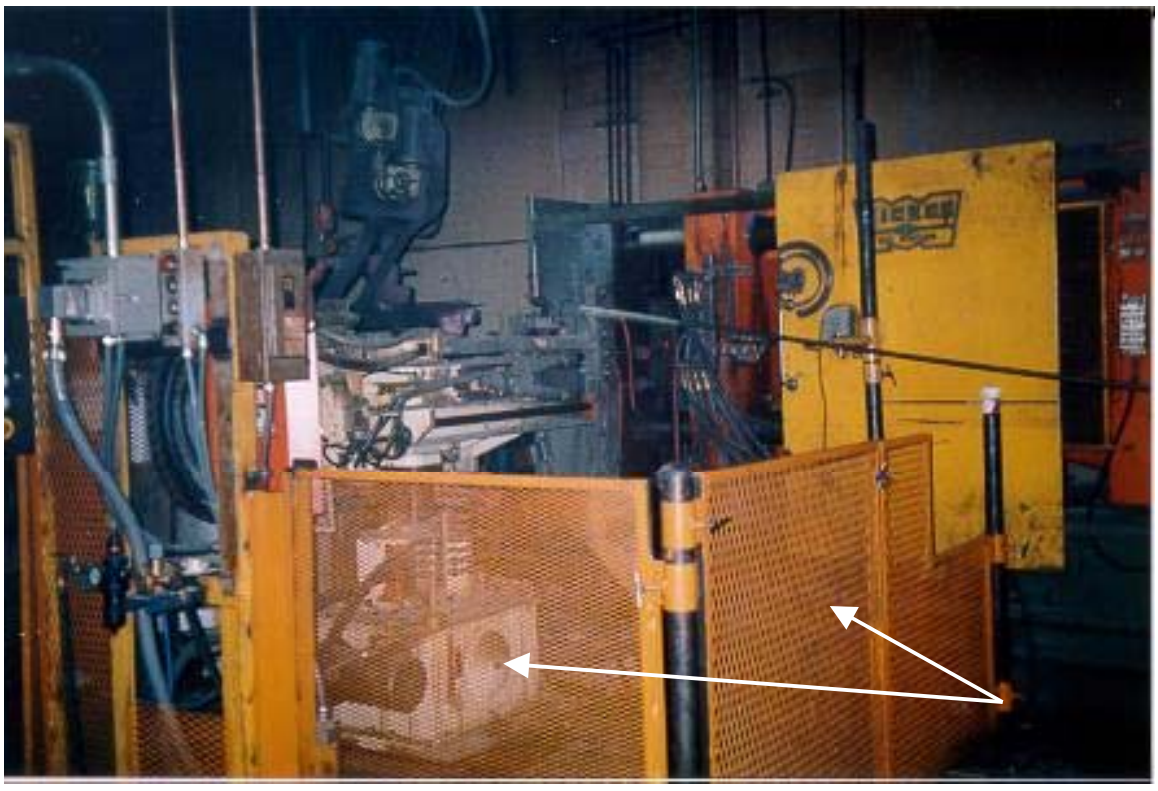

Figure 2 - The Die Casting Machine's Die.
The arrow points at the location where the two sections of the die come together.