

MIFACE INVESTIGATION: #02MI090

SUBJECT: Journeyman Pipefitter Killed When Struck in Head by Grooved End Cap under Pressure

Summary

On Tuesday, October 29, 2002, a 49-year old journeyman pipefitter was struck in the head by a 6-inch diameter grooved cap he was removing from the end of a pipe. The pipe had been pressurized to test its integrity and was still under 100 pounds of air pressure. The force of the blow from the cap striking him in the face knocked him backwards over the rail of the scissors lift that he was standing on to a concrete floor 14 feet below. When his co-worker, working on the lift immediately to the left of the victim, heard the noise, he looked to his right, but the victim was already on the floor below the lift. Figure 1 is a photograph of the pipes on which the men were working with the scissors lift (shown in the retracted position) below. The second pipe from the left is the pipe involved in the fatality. It was recessed into the wall opening from the force of the end cap exploding off of it.

Another co-worker who heard the noise came to assist and found the victim bleeding from the face and having difficulty breathing. EMS arrived shortly, treated the victim, and transported him to the emergency room of a local hospital. He died in the hospital eighteen hours later.

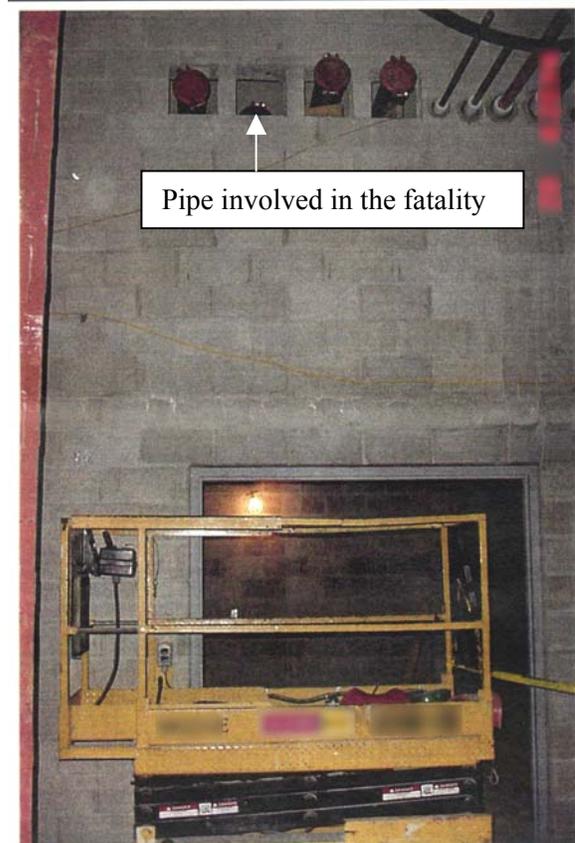


Figure 1 Pipes and Scissors Lift

RECOMMENDATIONS

- Employers should ensure that their written accident prevention plan identifies and describes all hazards that could be encountered in the worksite and how to recognize and avoid them.
- Develop a specific standard operating procedure for the task including tagging the valves with time and date of pressurization.
- Use an end cap that remains attached to the pipe during loosening as the pressure is relieved and prior to removal, or outfit the end cap with a pressure relieving device.
- Periodically reinforce skill and safety training.

INTRODUCTION

On Tuesday, October 29, 2002, a 49-year old journeyman pipefitter was struck in the head by a 6-inch diameter grooved cap he was removing from the end of a pipe. He died in the hospital 18 hours later. On October 30, 2002, MIFACE investigators were informed by the Michigan Occupational Safety and Health Act (MIOSHA) personnel who had received a report on their 24 hour-a-day hotline that a work-related fatal injury had occurred. On February 28, 2003, the MIFACE researcher interviewed the president of the company that employed the pipefitter. He described the events on the day of the fatality as they had been told to him by the pipefitter's co-worker. He accompanied the researcher into the plant, showed her various parts used for blanking pipes and described their functions, and allowed her to photograph them. The company president also provided the author with photographs of the site where the fatality occurred, copies of the company's newly developed pressure piping testing and lock out/tag out procedures, and copies of several pages of commercially available welded fittings, flanges, flange adapters, and couplings. During the course of writing the report, the medical examiner's report, the autopsy, the responding police department's report and photographs, and the MIOSHA citations were obtained.

The company for whom the pipefitter worked was a mechanical contracting company that installed systems that convey fluids. It had approximately 60 employees, 30 of whom had the same job title as the victim, journeyman pipefitter. The company had been in business for 53 years. The pipefitters were represented by a union. The company was subcontracted to do the work at the site of the fatality. They had been working there approximately six months.

The victim had been a pipefitter for 20 years. He was 49 years old. He had been working for this company for four years. He had not received specific training from his employer for the task he was doing at the time of the incident. His shift started at 7:00 a.m. and ended at 3:30 p.m. He had not been working overtime. The incident occurred at approximately 3:00 p.m. This employer had never had a fatality occur.

The vice-president of the company had primary responsibility for safety, and he reported to the president. He delegated safety responsibilities to the foreman at the jobsite. The vice-president and the site foremen had been trained in various aspects of safety including confined space entry and fall protection. Their training was gained through seminars, conferences, classes and on-the-job. The company had a written safety training program and held weekly safety meetings. Training was provided by the company, the manufacturers of the products they used, and consultants. They used toolbox talks from the Mechanical Contractors Association of America for portions of their training.

The MIOSHA investigation resulted in two violations being issued to the company: one Serious violation for failing to develop, maintain, and coordinate an accident prevention program that included a procedure for the task involved in the fatality; and one Other violation for failing to provide the operator of an aerial work platform with an aerial work platform permit.

INVESTIGATION

On Tuesday, October 29, 2002, at approximately 3:00 p.m., a 49 year-old journeyman pipefitter and his co-worker were standing side by side on a scissor lift preparing to remove 6-inch Victualic grooved end caps



Figure 2 Closed Pressure Relief Valves

from two pipes in preparation for fitting an elbow between the two. They were not wearing fall arrest protection nor were they tied off, because of the type of scissors lift they were working from. The stability of the 30-inch wide scissors lift could have been compromised in the case of a shock load such as could occur with an arrested fall.

The pipes had been pressurized previously with air to 100 psi to test for leaks by the pipefitter. To pressurize the pipes, a test header apparatus was connected to a valve in each of the pipes. The apparatus consisted of a pressure gauge attached between lines connected to the valve on each pipe and a compressed air cylinder. The pipes were pressurized in a separate room approximately 50 feet from where the workers were working. After pressurizing the pipes to the desired psi, the valves were closed and the apparatus removed. Figure 2 shows the pipe valves in the closed position.

The victim would have been the person to depressurize them. As the pipefitter loosened the bolts on the coupling in front of him in preparation for removing the end cap, the 5-pound, 6-inch diameter cap exploded from the end of the pipe. It struck him in the face with sufficient force to push him over the rail of the scissors lift. He fell 14 feet to the concrete floor below onto his head. When his co-worker heard the noise, he turned to look,



Figure 3 Coupling (left) and retrofitted grooved cap

but the victim was already on the floor below the lift. Another worker heard the noise, came to investigate and found the victim bleeding profusely from the face and having difficulty breathing. EMS personnel arrived shortly, treated the victim at the site and transported him to a local hospital where emergency treatment was continued. He died eighteen hours later in the hospital.

Figure 1 is a photograph of the pipes on which the men were working with the scissors lift (shown in the retracted position) below. The second pipe from the left is the pipe involved in the fatality. It was recessed into the wall opening from the force of the end cap exploding off of it.

Part of the victim's responsibility would have included bleeding the air from the pipes before he and his partner removed the caps. The usual practice was to bleed the air from the pipes after 24 hours. These pipes had been pressurized longer than 24 hours before the incident, but there was some question regarding when he had originally pressurized them. These pipes may have been pressurized for three weeks.

The cap that was used to blank the pipes was referred to by several names. It was called a grooved cap, or Vic cap, or grooved plug. These names describe a method of blanking a pipe that consists of bolting a coupling with a gasket in which the cap or plug is seated onto the end of the pipe. The two pipes on the right in Figure 1 are shown with an end cap attached. Figure 3 shows a coupling and a grooved cap retrofitted with a pressure relieving valve. The caps used at the time of the incident did not have pressure relieving valves.

The following safety changes were made before the MIFACE investigation:

- Company employees were instructed to discontinue use of the grooved cap or plug unless drilled and tapped and outfitted with a valve to relieve pressure.

- All grooved caps were drilled, tapped and a pressure relieving valve was added in the center of each.
- Pressure piping testing procedures and lock out tag out procedures for the testing were written and distributed to company workers. They included an Inspection Test Report that must be signed off by the job superintendent and the mechanical inspector. The company's written procedures are included as Appendix 1.

CAUSE OF DEATH

The cause of death as stated on the autopsy summary was "head injuries received at approximately 2:45 p.m. on October 20, 2002, when he was struck by the suddenly released cap of a steam pipe from which he had removed the securing bolts, followed by a fall from an aerial lift platform to a concrete floor. There were numerous facial fractures and left-sided brain injuries. He survived approximately 18 hours in the hospital. No other serious injuries nor any sign of disease contributing to death were present either during hospitalization or a postmortem examination." His heart, right lung, and kidneys were removed for organ donation.

RECOMMENDATIONS/DISCUSSION

- Employers should ensure that their written accident prevention plan identifies and describes all hazards that could be encountered in the worksite and how to recognize and avoid them.

In this case the employer did have an accident prevention plan, but the plan did not include a procedure for ensuring that the pipe had been depressurized. At a construction site where it is not possible nor appropriate to observe skilled tradesmen constantly, an accident prevention program that identifies and describes the potential hazards to be encountered during the work serves to highlight and reinforce information that the workers bring to the job. Why the pressure had not been bled off will never be known, but a reminder regarding the procedure at the beginning of the project as part of the accident prevention plan, however elementary it might have seemed to the workers, might have prevented this incident.

- Develop a specific standard operating procedure for the task including tagging the valves with time and date of pressurization.

Attachment 1 of this report is an example of the type of standard operating procedure developed for this task. Apparently it is not unusual for an air test to be left on for several days. Because the air test apparatus was removed, it would have been appropriate to tag the lines as a reminder that they were pressurized. A red tag on the lines would have been a reminder to the crew that the lines were still under pressure.

- Use an end cap that remains attached to the pipe during loosening as the pressure is relieved and prior to removal, or outfit the end cap with a pressure relieving device.

The employer's retrofit of the grooved caps the company now uses was one way to ensure a cap would not be allowed to explode from the end of a pressurized pipe. There are other fittings such as blind flanges that can be purchased to blank a line that stay attached to the pipe until the pressure is bled off as they are being removed. Whichever method is used to guard against a cap exploding from the end of a pressurized line, the most important control is to make every effort and plan to ensure the line is depressurized first.

- Periodically reinforce skill and safety training.

According to a journeyman pipefitter, apprentice and journeymen pipefitters are taught always to walk down a piping system and open any drains or vents to ensure the line they are penetrating has no pressure on it. Familiarity with a task often leads to a lax attitude regarding the steps to be followed to perform a job safely. Reinforcement of safety training serves to remind experienced workers that they can never become complacent. Appropriate consideration given to the type and value of the training can also indicate to the workers that working safely is viewed as an important element of the job and safety is not simply being given lip service.

REFERENCES

1. Accident Prevention Manual for Business & Industry, Engineering and Technology, 11th Edition, National Safety Council, Chicago, 1997.
2. MIOSHA Standards cited in this report can be found at www.michigan.gov/mioshastandards. The Standards can also be obtained for a fee by writing to the following address: Department of Consumer and Industry Services, MIOSHA Standards Division, P.O. Box 30643, Lansing, MI 48909-8143. MIOSHA phone number is (517) 322-1845.

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Attachment 1

Pressure Piping Testing Procedures And Lock Out/ Tag Out Procedures

All pressure testing of pressure piping systems and related mechanical equipment and all work on existing pressure piping systems and equipment will conform to the following procedures:

- All pressure piping that requires testing will be tested at the minimum pressures and durations required by the Specifications or applicable Codes.
- Grooved caps or plugs used to blank lines for testing must be drilled & tapped, and fitted with a shut-off valve. These valves must be open before attempting to remove the grooved cap or plug.
- When opening a valve or removing a grooved cap, grooved plug, blind flange, screwed cap, or screwed plug from the end of a line, do not stand directly in front of it.
- Pressure tests shall be removed as soon as practical by a qualified mechanic after the piping system or mechanical equipment passes the test's pressure and duration requirements. If there is more than one qualified mechanic at the site, a second qualified mechanic will confirm that the pressure has been removed.
- A written Company Inspection Test Report will be filled out to document the test and to verify that the pressure has been removed before further work on the system or equipment can commence.
- When tying into or working on a customer's existing system or equipment, we will comply with our customer's lock out & tag out procedures. In addition:
 - If we have to perform maintenance or repair on any machinery, equipment, or process with stored energy or pressure, it will be locked out or tagged out. Only qualified mechanics will engage in lock out and tag out procedures.
 - Electricity should be locked out at the panel box.
 - Pressure piping systems & related mechanical equipment should be shut-off and bled out. The valves shall be locked out or tagged out. If there is more than one qualified mechanic at the site, this should be confirmed by a second qualified mechanic.
 - Only the person who locked out or tagged out a source of energy should remove the lock or tag.
- The following definitions apply to this procedure:
 - Lock Out means the source of energy or pressure can't be turned on because a locking device has been placed on the switch, lever, valve, etc.
 - Tag Out means there is a warning tag attached to the source of energy or pressure to communicate to others not to turn on the source of energy or pressure
 - Qualified Mechanic is journeyman plumber, journeyman pipefitter, or service technician employed by _____ Co. or the equivalent employed by a customer or appropriate contractor (e.g. journeyman electrician).

INSPECTION TEST REPORT

Owner: _____

Date of Test: _____

Project: _____

Project Number: _____

Contractor: _____

Test Number: _____

Reference Dwg. No. _____

Type of Test: _____

Location of Pipe: _____

Location of Test: _____

Type of Pipe & Joints: _____

Test Pressure: _____ psi Duration: _____ hours

Signature: _____

Test Pressure Removed: _____ Signature

Test Pressure Removed Confirmed: _____ Signature

Remarks: _____

Leakage: _____

PASS _____

FAIL _____

Superintendent

Mechanical Inspector

MIFACE

Investigation Report # 02 MI 090

Evaluation

To improve the quality of the MIFACE program and our investigation reports, we would like to ask you a few questions regarding this report.

Please rate the following on a scale of:

Excellent	Good	Fair	Poor
1	2	3	4

What was your general impression of this MIFACE investigation report?

Excellent	Good	Fair	Poor
1	2	3	4

Was the report...

	Excellent	Good	Fair	Poor
Objective?	1	2	3	4
Clearly written?	1	2	3	4
Useful?	1	2	3	4

Were the recommendations ...

	Excellent	Good	Fair	Poor
Clearly written?	1	2	3	4
Practical?	1	2	3	4
Useful?	1	2	3	4

How will you use this report? (Check all that apply)

- Distribute to employees and/or family members
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- Use in employee training
- File for future reference
- Will not use it
- Other (specify) _____

Thank You!

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