



Equipment Operator Killed by a Lock Ring Propelled from a Multi-piece Rim Wheel

Case Report: 07NY137

SUMMARY

In December 2007, a male equipment operator was fatally injured by a metal lock ring propelled from a multi-piece wheel tire assembly he was inflating. The victim was employed by an excavating and snow removal company. At the time of the incident, he and a co-worker were getting their loaders ready to remove snow from a shopping mall parking lot. Soon after he started his loader, the victim noticed that his left front tire mounted on a multi-piece wheel was “soft”(under-inflated). The multi-piece rim wheel referring to the tire assembly consisted of six components: the rim base, valve assembly, tire, side ring, O-ring and lock ring. The function of the lock ring was to hold the tire in place by locking and securing the other wheel components when the tire was inflated. The victim asked the co-worker, whose loader had an air compressor, to put air in the tire. The initial tire pressure was not checked. The co-worker connected one end of an air hose to the quick-connect fitting on the air compressor and the clip-on chuck at the other end to the valve stem of the tire. The co-worker then went to his loader’s cab and used the throttle control to maintain the airflow. The air hose did not have an in-line pressure gauge. The victim checked the air pressure at the tire valve with a hand-held pressure gauge periodically as the tire was being inflated. The maximum cold tire inflation pressure specified by the tire manufacturer was 35 pounds per square inch (psi). After a few minutes, the victim informed the co-worker that the air pressure in the tire was about 15 to 20 psi. This was well below the 80% of the manufacturer recommended pressure. Under such tire pressure, the Occupational Safety and Health Administration requires the tire to be completely deflated, and the tire assembly to be dismounted from the vehicle, disassembled, inspected and reassembled prior to inflation. The co-worker told the victim not to let the pressure exceed 30 psi. As the victim continued inflating the tire, the co-worker placed a phone call from his cab to the owner of the company. As soon as he hung up the phone, the co-worker heard a loud noise. He ran to where the victim was and saw the victim lying on the ground with head injuries. The victim apparently was struck in the head by the lock ring that was propelled from the tire assembly. The co-worker immediately notified a mall security staff who called 911. Emergency medical services arrived within minutes. The victim was airlifted to a trauma center where he died two days later.

New York State Fatality Assessment and Control Evaluation (NY FACE) investigators concluded that to help prevent similar incidents from occurring in the future, employers should:

- ***develop, implement and enforce a standard operating procedure (SOP) for inflating multi-piece rim wheels that requires that only trained workers service or inflate multi-piece rim wheels***
- ***ensure that all equipment operators receive training and demonstrate competency on the SOP as well as the safety hazards and precautions associated with inflating a multi-piece rim wheel; and***

- *provide an air hose that has an in-line pressure gauge and sufficient hose between the in-line pressure gauge and the clip-on chuck to allow workers to stay outside the trajectory of wheel parts when inflating a tire.*

INTRODUCTION

In December 2007, a male equipment operator was fatally injured by a metal lock ring propelled from a multi-piece rim wheel he was inflating. New York State Fatality Assessment and Control Evaluation (NY FACE) staff learned of the incident through a newspaper article. The Occupational Safety and Health Administration (OSHA) investigated the incident. NY FACE staff interviewed a tire service manager of a commercial tire service facility to collect information on servicing multi-piece rim wheels. NY FACE developed this report based on the information collected through reviewing the OSHA and police investigation reports and interviewing the tire service manager. The death certificate was also reviewed.

The victim was employed by an excavating and snow removal company that had 18 employees. The company had developed safety and health programs mandated by OSHA to address excavation and road construction hazards. A local tire shop performed major tire service for the company. Inflation of a flat tire was not considered part of the tire service and was usually done by the employees. The company did not have a standard operating procedure (SOP) for inflating multi-piece rim wheels. According to OSHA, the employer did not provide employees with appropriate training to address the hazards and safety precautions associated with inflating multi-piece rim wheels.

The victim was hired as an equipment operator two months prior to the incident. Before his employment with the excavation company, the victim operated heavy equipment as a combat Marine in Iraq. The company reported that the victim was a competent equipment operator. This was the company's first work-related fatality.

INVESTIGATION

At the time of the incident, the excavating and snow removal company was contracted to provide snow removal services for a shopping mall. The victim was a member of the snow removal crew that operated loaders with snow pushing attachments to clear snow from the mall parking lots.

The victim operated a front-end loader that was a 1985 model. The loader was equipped with four pneumatic tires, size 17.5-25. The tires were 12 ply, load range F and equipped with tubes. The manufacturer specified 35 pounds per square inch (psi) as the maximum cold tire inflation pressure. The hazard warning on the tire stated that serious injury may result from under-inflating, overloading or improperly mounting a tire and that "only specially trained persons should mount tires"(Photo 1).

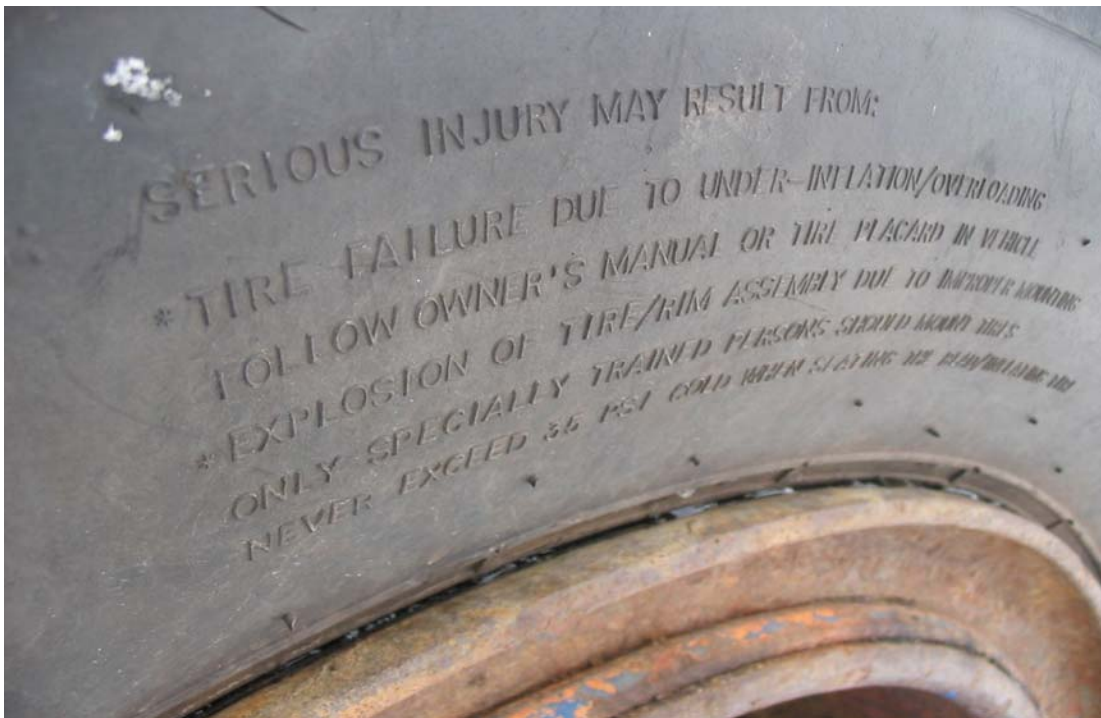


Photo 1. The warning on the tire addressing the hazards associated with under-inflating, overloading and improper mounting a tire (Photo courtesy of OSHA).

Three of the four tires, including the one that was involved in the incident, were mounted on wheels that were multi-piece type or split wheels. The multi-piece rim wheel in this case consisted of six components: the rim base, valve assembly, tire, side ring, O-ring and lock ring (Figure 1). The function of the lock ring was to hold the tire in place by locking and securing the other wheel components when the tire is inflated. The multi-piece rim wheel involved in the incident was installed in August 2006.

On the morning of the incident, the victim and another equipment operator (co-worker) arrived at the mall pump house where the two loaders were parked and started the loaders at approximately 4:30 AM

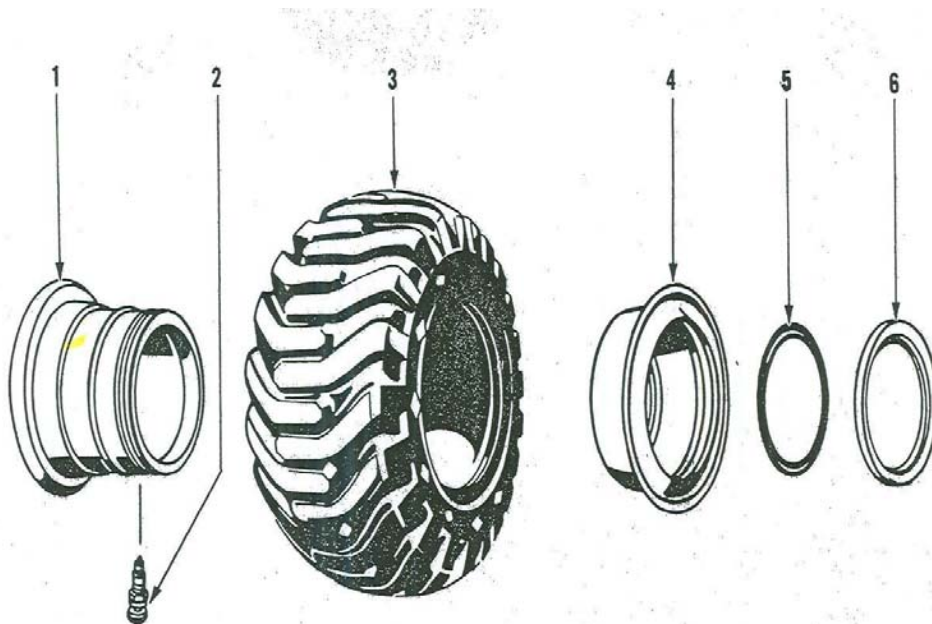


Figure 1. Components of the multi-piece rim wheel: 1. rim base, 2. valve assembly, 3. tire, 4. side ring, 5. O ring, and 6. lock ring (figure courtesy of OSHA).

to warm up the machines. According to the co-worker, soon after the victim started his loader, he noticed that the left front tire on his loader was “soft” or under-inflated (Photo 2). The victim asked the co-worker, whose loader had an air compressor, to put air in the tire. After waiting for the machine to warm up, the co-worker backed his loader over to the victim’s loader and retrieved an air hose from his cab. The air hose was approximately 25 feet long and half-inch in diameter with a clip-on chuck on one end (Photo 3). It did not have an in-line pressure gauge. The co-worker connected one end of the air hose to the quick-connect fitting of the air compressor on his loader. According to the coworker, the victim was having trouble attaching the clip-on chuck to the tire valve stem. The co-worker attached the chuck to the tire valve for the victim. He then returned to his loader's cab and used the throttle control to maintain the airflow.



Photo 2. The loader that was operated by the victim on the morning of the incident. The left front tire was under-inflated at the time of the incident. (Photo courtesy of OHSA)



Photo 3. The air hose that was used by the victim and the co-worker during the incident. The hose had a clip-on chuck on one end. It did not have an in-line gauge (Photo courtesy of OSHA).

The initial tire pressure was not checked. Periodically, as the tire was being inflated, the victim checked the air pressure at the tire valve with a hand-held pressure gauge (Photo 4). According to the co-worker, the victim informed the co-worker that the air pressure in the tire was about 15 to 20 psi after a few minutes of injecting air into the tire. This was well below 28 psi, that was 80% of the manufacturer recommended pressure of 35 psi. The co-worker told the victim not to let the pressure exceed 30 psi.



Photo 4. The hand-held air pressure gauge used by the victim during the incident (Photo courtesy of OHSA).

As the victim continued inflating the tire, the co-worker placed a phone call from his cab to the owner of the company to find out where they should be plowing that morning. As soon as he hung up the phone, the co-worker heard a loud noise. He ran to where the victim was and saw the victim lying on the ground approximately ten feet from his loader with head injuries. The victim apparently was struck in the head by the lock ring that was propelled from the multi-piece rim wheel (Photo 5 and Photo 6). The co-worker was about to dial 911 when he saw a mall security truck driving by. He immediately stopped the truck and informed the mall security staff about the incident. The mall security staff called 911. Emergency medical services arrived within minutes. The victim was airlifted to a trauma center where he died two days later.



Photo 5. The lock ring that was propelled from the multi-piece rim wheel; it struck the victim while he was inflating the rim wheel (Photo courtesy of OSHA).



Photo 6. The dislodged lock ring was being refitted to the multi-piece wheel that was involved in the incident (Photo courtesy of OSHA).

RECOMMENDATIONS/DISCUSSION

Recommendation #1: *Employers should develop, implement and enforce a SOP for inflating multi-piece rim wheels that requires that only trained workers service or inflate multi-piece rim wheels.*

Discussion: The employer in this case had a local tire shop perform major tire services including mounting, dismounting, balancing, and repairing multi-piece rim wheels. However, inflating a tire was commonly done in the field by equipment operators and was not considered major tire service. The company did not have a SOP and the equipment operators were not trained on how to safely inflate multi-piece rim wheels.

If a tire mounted on multi-piece wheel loses a significant amount of air, the wheel components that are secured in the rim base under the normal tire air pressure may be offset or dislodged. When the flat tire is inflated, due to the rapid increase of the air pressure and volume, the dislodged wheel components can be propelled at great distances with great forces and can cause serious injury or death to anyone in the trajectory area. The victim and the co-worker in this case apparently were not aware of the danger of inflating a multi-piece rim wheel.

OSHA requires that if the pressure in a multi-piece rim wheel is reduced to 80% or below the recommended operating pressure, the tire assembly shall be completely deflated, removed from the vehicle, disassembled, inspected and reassembled prior to inflation. These should only be done by professional tire services. Maintenance personnel or equipment operators should never attempt to perform the job in the shop or the field.

Employers should establish and implement a SOP for the workers to follow when performing this hazardous task. The SOP should include, at a minimum, the following components:

1. ***Stay out of the trajectory of rim wheel parts at all times while inflating a tire mounted on a multi-piece wheel*** because wheel parts may be propelled with great force and cause serious injury (Figure 2).
2. First measure the air pressure in the tire with an in-line air gauge and inspect the tire components when encountering a flat multi-piece rim wheel.
3. If the tire has more than 80% of its recommended pressure and no obvious damage is observed, use an air hose that has an in-line air gauge and sufficient hose length between the clip-on chuck and the in-line gauge. Attach the clip-on chuck to inflate the tire.
4. Check the in-line air gauge and ensure that the air pressure does not exceed the recommended cold tire inflation pressure.
5. ***Do not inflate the tire on the vehicle*** if the tire is 80% or below its recommended operating pressure or if it has obvious or suspected damage.
6. Immediately place a warning label on the tire and inform the supervisor who should contact a tire service company to order service.
7. Do not return the tire to service unless it is completely deflated, removed from the vehicle, disassembled, inspected, reassembled and re-inflated by the tire service company.

Recommendation #2: *Employers should ensure that all equipment operators receive training and demonstrate competency on the SOP as well as the hazards associated with inflating a multi-piece rim wheel.*

Discussion: Employers should ensure that all equipment operators receive training on the SOP for inflating a multi-piece rim wheel. Employers should train workers in the recognition of the hazards associated with inflating multi-piece rim wheels. Workers should be informed that improper handling of a multi-piece rim wheel can cause serious injuries or deaths. No employees should be allowed to inflate a multi-piece rim wheel unless the employee receives training. Employers need to ensure that each worker demonstrates and maintains the skill and ability to correctly assess a multi-piece rim wheel and inflate the tire assembly safely.

Recommendation #3: *Employers should provide an air hose that has an in-line pressure gauge and sufficient hose length between the in-line pressure gauge and the clip-on chuck to allow workers to stay outside the trajectory of the wheel components when inflating the tire.*

Discussion: Employers should provide every field equipment operator who may inflate a multi-piece rim wheel an air line assembly consisting of the following components: a clip-on chuck, an in-line valve with a pressure gauge or a pre-settable regulator and a sufficient length of hose between the clip-on chuck and the in-line gauge. Remote control inflation equipment may also be provided. All of this equipment enables the workers to stay outside the trajectory that propelled wheel parts may travel when inflating the tire.

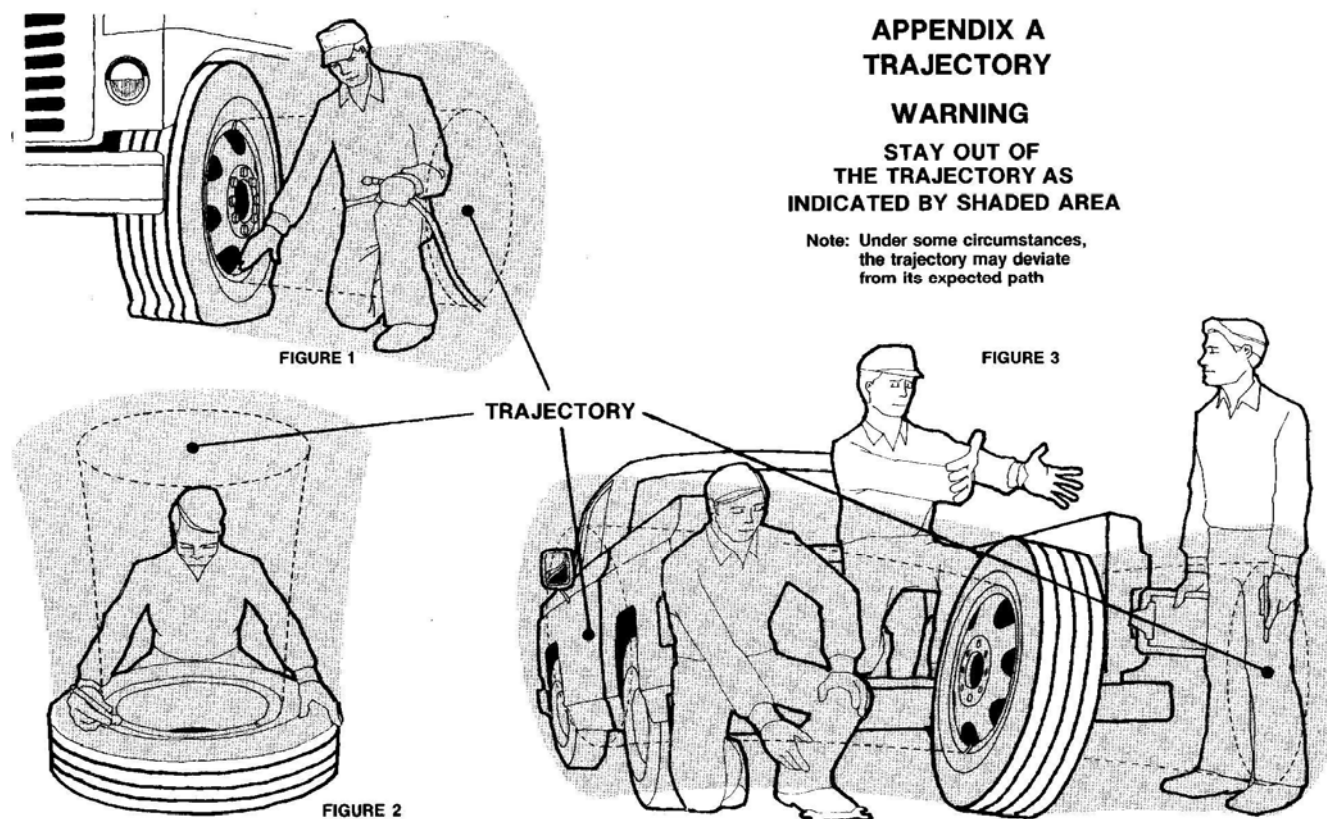


Figure 2. Trajectory of a multi-piece rim wheel parts (Source: OSHA 1910.177 Appendix A)

Keywords: *split rim wheel, multi-piece rim wheel, inflating tire, lock ring, front-end loader, equipment operator*

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The Fatality Assessment and Control (FACE) program is one of many workplace health and safety programs administered by the New York State Department of Health (NYS DOH). It is a research program designed to identify and study fatal occupational injuries. Under a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), the NYS DOH FACE program collects information on occupational fatalities in New York State (excluding New York City) and targets specific types of fatalities for evaluation. NYS FACE investigators evaluate information from multiple sources. Findings are summarized in narrative reports that include recommendations for preventing similar events in the future. These recommendations are distributed to employers, workers, and other organizations interested in promoting workplace safety. The FACE program does not determine fault or legal liability associated with a fatal incident. Names of employers, victims and/or witnesses are not included in written investigative reports or other databases to protect the confidentiality of those who voluntarily participate in the program.

Additional information regarding the New York State FACE program can be obtained from:

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www.nyhealth.gov/nysdoh/face/face.htm