



## **Massachusetts FACE • Occupational Fatality Report**

Massachusetts Department of Public Health  
Occupational Health Surveillance Program  
Fatality Assessment and Control Evaluation Project



### **Mechanic Dies while Changing a Tire Mounted on a Multi-piece Split Rim Wheel - Massachusetts**

**Investigation: # 07-MA-058-01**  
**Release Date: October 20, 2009**

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#### **SUMMARY**

On December 31, 2007, a 59-year-old male mechanic (victim) was fatally injured while changing a container handler's dual front inner tire that was mounted on a multi-piece split rim. While removing the outer multi-piece split rim wheel to access the inner wheel, it exploded off the container handler striking the victim and pushing him into the mast of a forklift. A co-worker found the victim lying on his back on the ground with the outer tire on top of him. The co-worker placed a call for the local police; personnel from the local police and fire departments arrived within minutes. The victim was transported to a local hospital where he was pronounced dead. The Massachusetts FACE Program concluded that to prevent similar occurrences in the future, employers should:

- **Ensure that all multi-piece rim wheel tires are deflated prior to removing them from a vehicle's axle.**
- **Ensure that employees never position themselves in the trajectory (in front of or over) of inflated tires mounted on multi-piece rims.**
- **Perform routine inspections of all multi-piece rim wheels to identify damaged components.**
- **Ensure multi-piece rim wheels with mounted inflated tires are never struck with hammers or other objects.**
- **Develop standard operating procedures (SOPs) for servicing multi-piece rims and provide training on these procedures.**

#### **INTRODUCTION**

On December 31, 2007, the Massachusetts FACE Program was alerted by the local media that on the same day a 59-year-old mechanic was fatally injured when he was struck by an exploding tire. An investigation was initiated. On January 25, 2008, the Massachusetts FACE Program Director traveled to the company's office and the incident location. The police report, death

certificate, and company information were reviewed during the course of the investigation. In addition, photographs were taken of the incident location and the container handler, the vehicle involved in the incident.

The employer is an international intermodal freight transport company that includes cargo container terminal locations and rail and trucking transportation. The company also provides warehouse and full service maintenance services. The company has been in business for 23 years and has multiple locations in the state. The company location where the incident occurred had been in operation for 16 years. The company employs approximately 80 employees, 17 of whom hold the same job title as the victim, mechanic. The victim had worked for the company for eight years and was a career mechanic.

The company did not have a designated person in charge of employee safety and health or a written safety and health program. The company did have a safety committee and buddy system for employees. The company stated that they typically hire employees with previous experience and provided minimum employee training. Training on the proper operation and maintenance of the container handler was provided by the manufacturer of the container handler to the mechanic supervisor and machine operator supervisor. These supervisors would then train the mechanics and machine operators. It was reported that the company had standardized verbal procedures and some generic written practices for changing tires on the equipment. Employees were not part of a collective bargaining unit.

## **INVESTIGATION**

The company, an international intermodal freight transport company, receives international shipment containers via railroad. The machine on which the victim was working when the incident occurred was a container handler (Figure #1). Container handlers are used to move large metal cargo containers (Figure #2) and are equipped with large hydraulic lifting arms located in the front of the machine. The company's main tasks once a cargo container arrives onsite are to ensure the containers are cleared by customs and then released to their owners or designees. The container handlers are used to pick the cargo containers up off the railroad cars on which they arrived and move them either to the company's storage location, or onto one of the company's flatbed tractor trailers or another company's flatbed tractor trailer to be transported to another location.

The container handler involved in the incident was manufactured and purchased in 1999 and was one of eight container handlers that the company owns. This container handler has a diesel fueled engine, an operator's area with a totally enclosed cab, and it can lift approximately 100,000 pounds. To lift a container, the container handler's lifting arms are lowered to the top of a large cargo container and are latched onto the container. Once the cargo containers are attached to the container handler's lifting arms, the containers are lifted and moved horizontally to a storage location where the container can be stacked onto other cargo containers or onto the flatbed trailer section of a tractor trailer or train.

This container handler is equipped with six wheels, four in the front (dual wheels) and two in the rear. All of the wheels are multi-piece split rim wheels<sup>a</sup> with 21.00x25 size tubeless rubber tires (approximately 23 inches wide and 69 inches high) (Figure #3). These multi-piece split rim wheels consist of five components, an inner and an outer rim, a collar, and two rings, one of which is a locking ring. The front outer wheels of the container handler are each fastened to the vehicle's axle with 28 lug nuts and clips. The company reported that this container handler had not been altered and that maintenance schedules are followed for all equipment. Most of the equipment maintenance is performed onsite by the company's mechanics.

The incident occurred on a Monday, which was the first day the victim was back at work after a few days of vacation. On this day, the victim arrived to work at 7:30 a.m. The night before the incident there had been light snow, and the morning of the incident the weather was clear with temperatures in the 30's.

One of the first jobs to be performed on the day of the incident was to repair the container handler involved in the incident. Due to the large size of these containers handlers, all of the maintenance tasks were performed outdoors. The task to be performed was to repair a flat tire on the front left inner wheel caused by a piece of metal that had been run over the Friday before. To access the wheel with the flat tire, the left front outer wheel, which was fully inflated, had to be removed first. The company reported that the left front outer wheel rim was original to the container handler and appeared to be in good shape. It was reported by the company that changing container handler tires was a job that that they routinely performed.

The procedure for changing a container handler's tire, as explained by the company representative, included, but was not limited to, first jacking up the container handler so only the tire(s) to be removed are off the ground. Then 22 of the 28 lug nuts and clips on the outer rim are removed and the six remaining lug nuts and clips should be in a star-like pattern. These remaining six lug nuts and clips are then loosened but not removed. It was reported that the rims will typically stick to the break drum and that the wheel is usually struck with a hammer to loosen it from the break drum. Once the outer wheel is loosened, a forklift is used to help lift and remove the tire from the axle and then move the tire out of the immediate area. Now accessible, the inner wheel is loosened and removed.

The victim had been working on changing the tire with a co-worker on the morning of the incident. At the time of the incident, the victim's co-worker had gone to the bathroom, and the victim continued to work at removing the outer wheel to access the inner flat tire. It was reported that the container handler was jacked up so that the two left front wheels, the wheels being

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<sup>a</sup> OSHA's definition of a multi-piece rim wheel is a vehicle wheel consisting of two or more parts, one of which is a side of locking ring that holds the tire and other components on the rim wheel by interlocking the components when the tire is inflated.

removed, were off the ground. It was also reported that all 28 of the lug nuts on the outer rim had been removed at the time of the incident.

The incident was not witnessed, but it appears that the victim was standing directly in front of the wheel and reportedly using a hammer to hit the outer split rim to loosen it from the break drum. The split rim wheel exploded off the container handler striking the victim. The victim was thrown backward approximately 12 feet and struck the mast of a forklift. The forklift was positioned with its tines lowered and facing the container handler's wheel in preparation to be used to lift and move the wheels off the container handler's axle.

When the victim's co-worker returned to the task location, he found the victim against the forklift's mast with the container handler's left outer tire on top of him. The co-worker placed a call for the local police. Personnel from the local police and fire departments arrived within minutes. The victim was transported to a local hospital where he was pronounced dead.

After the incident, it was discovered that the front left outer multi-piece split rim failed and had a crack within an inch of the rim's interior ring (Figure #4). During the site visit, the split rim that failed looked worn, rusty and had some pitting. The company stated that they were going to start conducting routine inspections of all of their multi-piece rim wheels. In addition they were now going to hire a tire company to maintain all of the container handlers' wheels.

## **CAUSE OF DEATH**

The medical examiner listed the cause of death as blunt head trauma with skull fractures.

## **RECOMMENDATIONS/DISCUSSION**

**Recommendation #1: Employers should ensure that all multi-piece rim wheel tires are deflated prior to removing them from a vehicle's axle.**

**Discussion:** This case underscores the importance of always deflating multi piece rim wheels prior to maintenance or removal from a vehicle. When multi-piece rim wheels are inflated, they are under great air pressure. It is this air pressure that holds the multiple components of the multi-piece rim wheel together. When there is an uncontrolled release of the air pressure from the tire, this causes the rim wheel components to separate. When the rim wheel components separate, they are usually dislodged causing them to be thrown at extreme speeds and violent force. Therefore, prior to removing a multi-piece rim wheel from a vehicle's axle, the tire should first be completely deflated by removing the core valve.

In this case, the container handler had dual wheels and the wheel that the victim was attempting to repair was an inner wheel. Although the outer rim wheel was not the wheel to be repaired, it had to be removed from the vehicle to access the inner wheel. It does not matter if only one of

the dual wheels is in need of repair. The first step that should be performed, even before loosening and removing any lug nuts, is to completely deflate both tires.

**Recommendation #2: Employers should ensure that employees never position themselves in the trajectory (in front of or over) of inflated tires mounted on multi-piece rims.**

**Discussion:** OSHA's definition of trajectory is any potential path or route that a rim wheel component may travel during an explosive separation, or the sudden release of the pressurized air (Figure #5). Therefore, when a rim wheel with an inflated tire is mounted on a vehicle, to minimize the hazard of being struck by a rim wheel component during an explosive separation or sudden release when working on the wheel, it is extremely important for employees to always stay outside of the trajectory. During tire inflation a cage or barrier should be used to protect workers from the hazard of being struck by a rim wheel component during an explosive separation or sudden release.<sup>1</sup>

In this case, the victim was standing directly in front, within the trajectory, of a multi-piece rim wheel that had an inflated tire mounted on it. Reportedly, the victim was using a sledge hammer to strike the rim wheel to loosen it from the container handler's axle. If the victim had been standing off to the side of the wheel, outside of the trajectory, when the rim wheel failed and explosively separated, his injuries might have been minimized or prevented.

**Recommendation #3: Employers should perform routine inspections of all multi-piece rim wheels to identify damaged components.**

**Discussion:** Employers should ensure that routine inspections of multi-piece rim wheels are performed. Employees conducting the inspections should be experienced and trained on multi-piece rim wheels (Recommendation #5), and the vehicle to which the wheel is attached, and has the authority to take immediate action to correct any problems including stopping work and taking equipment out of service.<sup>2</sup> Rim wheel inspections should start with deflating the tire while it is still securely tightened to the vehicle's axle by removing the valve core and then removing the wheel from the axle and disassembling all of the rim wheel components. Then visual assessments of each rim wheel component for any damage and deformities, such as rust, pitting, excessive wear, corrosion, cracks, bent areas, and any other potential damage should be performed. Any damaged or questionable parts found during inspections should be tagged, removed immediately from service and discarded or returned to the manufacturer.

In this case, the company did not perform routine inspections of their multi-piece rim wheels. If the employer performed routine inspections of the rim wheels then the cracked rim that failed might have been identified prior to the incident and taken out of service. In addition, if a visual assessment of the rim wheel was performed while it was still mounted on the container handler and prior to starting the removal of the wheel, it might have been noticed that there was some rusting and pitting present on the visible surface of the rim wheel. This visual assessment could

have alerted workers to the potential hazard and led them to properly perform a full inspection of the wheel.

**Recommendation #4: Employers should ensure multi-piece rim wheels with mounted inflated tires are never struck with hammers or other objects.**

**Discussion:** Multi-piece rim wheels with fully inflated mounted tires should never be struck with a hammer or any other object for any reason. Before any work begins on a rim wheel, including, but not limited to, loosening and removing the wheel from a vehicle and correcting the positioning (seating) of the rim wheel rings, the rim wheel's tire must be completely deflated. Properly deflating the tire will minimize the hazard of the wheel's air pressure being released uncontrollably and causing the rim wheel components to be forcefully dislodged.

**Recommendation #5: Employers should develop standard operating procedures (SOPs) for servicing multi-piece rims and provide training on these procedures.**

**Discussion:** Employers should develop standard operating procedures (SOPs) for servicing multi-piece rims and train all employees who will be servicing these rims. The SOPs should include proper procedures for demounting, inspecting, inflating and mounting multi-piece rims. SOPs should also include both the multi-piece rim manufacturer's and the tire manufacturer's instructions and recommendations and all applicable OSHA's standards.

OSHA has outlined safe operating procedures for multi-piece rim wheels in their standard 29 CFR 1910.177, *Servicing multi-piece and single piece rim wheels*. Some of the required procedures for servicing multi-piece rim wheels are listed below. The full text of this standard can be found at [www.osha.gov](http://www.osha.gov).<sup>3</sup>

- Tires shall be completely deflated before demounting by removal of the valve core.
- Employees must stay out of the trajectory when handling multi-piece rim wheels.
- Cracked, broken, bent or otherwise damaged rim components shall never be reworked, welded, brazed, or otherwise heated.
- Use a restraining device (cage or barrier) when inflating tires.
- After inflation, inspect tires and wheel components for proper seating while still within the restraining device. If not properly seated, then the tire must be deflated by removing the valve core before any adjustments are made.
- Never hammer or strike the rim wheel components while the tire is pressurized.

In addition, all employees should be cautioned regarding the potential hazards of multi-piece rims. But, it is extremely important that only employees who are assigned to service multi-piece rims and have been trained on the proper servicing of these rims, including demounting, inspecting, inflating and mounting procedures, are allowed to service the rims.

## REFERENCES

1. Massachusetts FACE project, FACE Facts, *Worker Killed While Inflating a Tire Multi-Piece Rim – Massachusetts*, Vol. 7, No. 2, August 2004, [www.mass.gov/Eeohhs2/docs/dph/occupational\\_health/face\\_fact\\_rim.pdf](http://www.mass.gov/Eeohhs2/docs/dph/occupational_health/face_fact_rim.pdf)
2. Equipment Manufacturers Institute, 1991, Wheel loader / tractor, Form # WLT70-1
3. Code of Federal Regulations, 29 CFR 1910.177, Servicing multi-piece and single piece rim wheels, Motor vehicles, U.S. Government Printing Office

**Figure 1 – Container handler involved in the incident.**



**Figure 2 – Cargo container.**



**Figure 3 – Container handler with replaced wheel.**





**Figure 4 – Rim component of the multi-piece rim wheel that failed.  
The arrow is pointing to the section of the rim component that cracked and failed.**



**Figure 5 - Trajectory of multi-piece rim parts in different scenarios.**

